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# Dangerous Tinkering!

EVERY CHEMICAL ENGINEER has some stake in the American patent system. It is so fundamentally a part of the science and technology of modern industry that anything which threatens to curtail its usefulness strikes at the very foundation of most of our jobs. Likewise, anything which may be done in the public interest to improve the effectiveness of a system that is admittedly imperfect is deserving of our earnest interest and support. Unfortunately, however, the patent system is too vital to be tampered with by amateur reformers and tinkering theorists. There is grave danger that instead of giving us worthwhile improvements, such meddling would actually slow up technological progress, lessen opportunities for new employment, substitute secrecy and destructive competition for well informed, economic and social advance.

Technical men should, therefore, do all they can to call attention to the social and economic benefits of patent protection. The Public Forum of the American Engineering Council in Detroit last month, and the several fine papers presented recently by Dr. J. V. N. Dorr, Dr. Frank P. Jewett and others are major moves in the right direction.

We must never lose sight of the fact that the patent system has always had the double purpose of (1) stimulating invention and (2) discouraging secrecy, by offering a reward of protection for immediate publication of new and useful knowledge. Chemical industry in particular has reason to know that a return to the old policies of universal secrecy would be suicidal retrogression. Patent protection becomes more and more necessary as our industries become more complicated and interdependent. Secrecy is possible only in the small, physically isolated business. Wholly new industries, with corresponding opportunities for new employment, cannot develop rapidly if dependent solely upon secret processes.

It is a grave question whether industrial research as practiced today could survive in the absence of a patent system or if licensing were made compulsory. Patentable inventions are not necessarily the end products of organized research, but they are definite steps toward the main objective—which is to make something new or better or cheaper. Dr. Jewett estimates that less than twenty-five per cent of the productive work in American laboratories leads to patents, yet these research and development organizations could not exist if they had no means of protecting and using the patentable results of their creative work.

The same experienced and resourceful research director has two constructive suggestions to offer as objectives for those who would really improve our patent system: (1) Revise and strengthen Patent Office procedure so as to increase the validity of issued patents; (2) Expedite and make more certain and less costly all litigation arising out of the employment of patents.

If the legislators in Washington who are involved in the present study of the patent system can somehow be shown the great opportunity for public service that would result from coordinated effort in these two directions, the scientists and engineers of the country may be counted on to keep alive the spirit of invention and progress, for the social benefit of the entire community.

# From an

### ANGLO-AMERICAN BONDS

EVEN THE MOST BITTER CRITICS of Secretary Hull's program of trade agreements have been strangely silent, or have even ventured guarded praise in commenting on the last and greatest of the tariff deals—those with Great Britain and Canada. The reason, of course, is broader than any detailed comparisons of reciprocal concessions in import duties. The significant fact is that this agreement between the two great English-speaking democracies came at a time when European relations were badly strained and political and economic difficulties were developing in South America. It came as a reassuring proof of the enduring strength of ancient bonds that have held closely together, in spite of friendly rivalry, the two nations that today control more than a quarter of all the world's trade.

With the signing of these pacts on November 17, we now have trade agreements with approximately twenty countries that account for 57.5 per cent of our exports and 60.6 per cent of our imports, according to the best estimates of *Business Week*. Nor should we lose sight of the fact that each of our reciprocal trade agreements carries in it a most-favored-nation clause that automatically extends all of its concessions to all other nations except those on our "black list"—of which Germany is the outstanding example at the moment. Thus each treaty is a two-edged sword in cutting through trade barriers throughout the world. What this new freedom might mean in more nearly normal times is still a matter of debate with the extremes on Secretary Hull's side promising world peace and prosperity while the tariff protectionists on the other are worrying with their fears of disastrous competition from abroad. The truth is somewhere between the two extremes. Only time and experience can tell how good a job has been done by our negotiators.

Chemical industry, as such, seems to have fared about as well as might be expected. There has been an evident attempt to fit together the complimentary patterns of our national resources and raw-material requirements, without greatly disturbing the more competitive lines of manufacture. However, a more serious threat may reside in the lowered tariffs on paper, textile and leather goods—all of which can displace domestic products made with American chemicals. This indirect competition may well prove a high price for our share of Anglo-American bonds.

### ANTI-MONOPOLY MEDICINE

WHILE WASHINGTON has been beating the bushes of industry and stirring up the trade associations in search of monopolistic trends and practices, the Public Affairs Committee of the American Society of Agricultural Engineers has been making a monopoly study along somewhat different lines. Its conclusion is as follows:

> This (study) shows that there is a trend away from monopoly and that this trend is due in a large measure to technical development. In the present-day world, attempts to boost prices and keep them at an unfair level are in danger of defeating themselves. Applied science is likely to find other means of progress. The man who tries to fence in an industrial highway and exact an unfair toll from all wayfaring consumers courts disaster. The chemist will build a detour around him, the physicist will dig a tunnel under him, or a biological overpath will be constructed. He may think he has throttled competition, but it will spring up again from new directions. Business is beginning to learn and respect this basic law.

It will probably be many years, however, before it can be understood and appreciated by the non-producers.

### UNUSUAL OPPORTUNITY

UNCLE SAM is going to hire more than 25 new chemists or chemical engineers, beginning at the unusually high government salary of $5,600 per year. These men will lead the staffs of the four new Regional Research Laboratories of the Department of Agriculture, which will carry out investigations on ways in which new industrial use may be made of the products of agriculture. Later several hundred more chemical and engineering investigators will be chosen to work under these leaders.

This is one of the most important undertakings which has ever been made in the United States to do fundamental work for the furtherance of the chemical process industries. This new chemical enterprise will not be a complete panacea for the troubles of agriculture, but the opportunity for service in this field has never been greater.

Selection of the new project leaders for these technical staffs will be made under Civil Service

# Editorial Viewpoint

regulations. It is to be hoped that numerous well qualified men will be found available. The spirit which governs the planning for this work is constructive. The process industries have everything to gain from support of the new research.

There is not the slightest evidence that the projects will put the government into business. That is neither the hope nor plan of the Department executives. All the government group wants to do is to assist in research on the great mass of agricultural raw materials so that new industries may develop that will be new outlets for agricultural commodities, new agencies of employment, new contributors to a higher standard of living for the country as a whole.

Let us hope that this spirit of the Department may attract able research workers. If it does, the whole profession will benefit, the cause of research generally will be advanced, and a great constructive service will be rendered to agriculture.

### KETTERING'S 1939 MODELS

ONE STIMULATING BYPRODUCT of the annual automobile shows in New York is the opportunity to hear and see "Boss" Kettering in action. He never lets you down. You can't leave an interview or listen to one of his luncheon talks without taking away some cheerful thought-provokers. Here are a few of the 1939 models:

> Never were there such opportunities for young men and women of ability as there are today. Never was there such an opportunity to do things, provided you don't do the same things we are doing now. We have got to open up new fields, and there are thousands of new fields standing waiting.
>
> You know we hear a great deal about technology unemployment and technological development. Because I have been in that business all my life I can speak freely without hurting my own feelings.
>
> We have today a very unusual condition in this country where we have an excess of materials, excess of money and excess of men. Now all that that can mean to a primitive mind like mine is that we haven't got any projects. That is all. Which means that we are technologically behind and not technologically ahead, and that if we could get this idea that we know very much out of our minds, and that the whole thing is ahead of us, then I think we would actually have a shortage of labor in this country in a short time.

Perhaps not a 1939 model, but a typical Charles F. Kettering quotation was cited by T. A. Boyd at the A.E.C. Public Forum last month in Detroit. He was emphasizing the place of research as a creator of jobs and quoted his "Boss" as follows:

> As a people, we've got to decide whether we are going to go on building America, or whether we are merely going to operate it. In the past the twin jobs of building and operating the national producing plant and the transportation and distribution systems have utilized most of our men and resources. Now are we going to drop back to the mere operation of the plant, or are we going to visualize new and greater industries ahead and begin to plan and build for them?

### FREDERICK CLEMENS ZEISBERG, 1888-1938

THOSE OF US who joined in the happy celebration of "Zip's" fiftieth birthday last spring in Charleston, or were with him last month as he competently presided over the Institute's three-day meeting in Philadelphia, can scarcely realize that he is gone. His interest and conscientious work for the chemical engineering profession seemed to spring from an almost inexhaustible source of energy and enthusiasm. And its inspiring influence must continue—even though we are deprived of our friend's living example.

Few chemical engineers knew of the nature and extent of Fred Zeisberg's contributions to our profession. He worked behind the scenes, tremendously hard but quietly and efficiently—a man of unquestionable integrity, self-educated, yet ever a student. His greatest concern was in building an enduring literature of chemical engineering and for most of the last dozen years he guided the work of the Publications Committee of the Institute. More than anyone else, he was responsible for the changes that are now so evident in the Institute's official Transactions. As chairman of the William H. Walker Award Committee, he helped to set up an achievement incentive to stimulate worthwhile contributions to the literature of the profession. Indirectly, he had a part in 1935 in establishing a yet unnamed "merit" award which at some future date, the American Institute of Chemical Engineers might bestow on its members who had made the most meritorious contribution to the profession.

That merit award, we respectfully urge, might well be given the name of Frederick C. Zeisberg. Furthermore, if it could be awarded posthumously, its first recipient should be the modest man of achievement who gave so much of his short life to the advance of the profession he loved.

# Viscose Rayon Spun Continuously

*For several years a subject of speculation by the rest of the rayon industry, the first units of Industrial Rayon Corporation's new continuous viscose spinning process have gone into successful operation at Painesville, Ohio. Through a subsidiary which manufactures the units, Industrial will offer machines and licenses to other viscose producers.*


THEODORE R. OLIVE
*Associate Editor*
*Chemical & Metallurgical Engineering*

Row of continuous spinning machines under construction in the Painesville plant of Industrial Rayon Corp.

AFTER SIX YEARS of experimental work and the expenditure of more than $2,000,000 for research, Industrial Rayon Corp., of Cleveland, has developed a process and built a plant for the production of viscose rayon on a continuous basis. First units of the new plant at Painesville, Ohio, have just gone into operation and when the plant is fully equipped, it will have a capacity in the neighborhood of 12,000,000 lb. per year. It will have cost $11,500,000 and will employ nearly 1,000 people in various phases of a process which is fully continuous from spinning pumps to twisted yarn.

When the new plant has been fully tuned up, it will have in operation a total of 9,600 spinnerets in the 3½ acre spinning room. That the relatively small operating force will not be offset by a large number of maintenance men—as has been predicted by some who knew of the plans projected by Industrial's engineers—has amply been proven by two years' production experience on the 100-spinneret semi-works machine in the Cleveland plant. In fact, H. B. Kline, vice president in charge of production, has assured the author that maintenance is expected to be actually less than in a normal viscose plant.

In its chemical end the new plant is essentially similar to other viscose plants and the production of the spinning solution still requires not much less than a week. But whereas the usual bobbin spinning machine serves only for the extrusion and coagulation of the yarn filaments—and the pot spinning machine adds only the twisting operation—the new continuous spinner also washes, desulphurs, bleaches, lubricates, dries and twists the yarn without more than routine attention from the operators. In addition, it can deliver dyed or sized yarn if desired.

Thus the new process compresses into about six minutes (the time from spinneret to dried, twisted yarn) operations which in other viscose plants require up to 90 hours. The time saving in itself is of no great importance, but it is indicative of the tremendous reduction of material in process which the new machine makes possible, and of the more efficient utilization of labor which is attained by the elimination of numerous batch processes.

Even more important in the belief of the Industrial organization is the much greater uniformity inherent in fiber produced under the exact control that can be built into the new machine. The number of variables is greatly reduced as compared with the batch process, and the perfect uniformity always claimed for man-made fibers is said to be more closely approached than ever before.

### Origin of the Idea

The story of Industrial's striking venture is in reality two stories: that of the continuous spinning machine, and that of the new plant, both of which are unique in rayon annals. In-

dustrial's management for some time had believed that the methods then employed in making bleached, coned viscose yarn for weaving were neither economical nor capable of producing a yarn of sufficient uniformity. For some time Mr. Kline had been discussing the need for a continuous spinning process and in the middle of 1932, Hiram S. Rivitz, president of the company, authorized the commencement of development work. A. H. Burkholder, research chemist, and Walter Knebusch, research engineer, were assigned the problem of developing a practical application of the idea of a sequence of operations which would carry yarn from spinning bath to a dry package without intermediate winding for processing in packaged form.

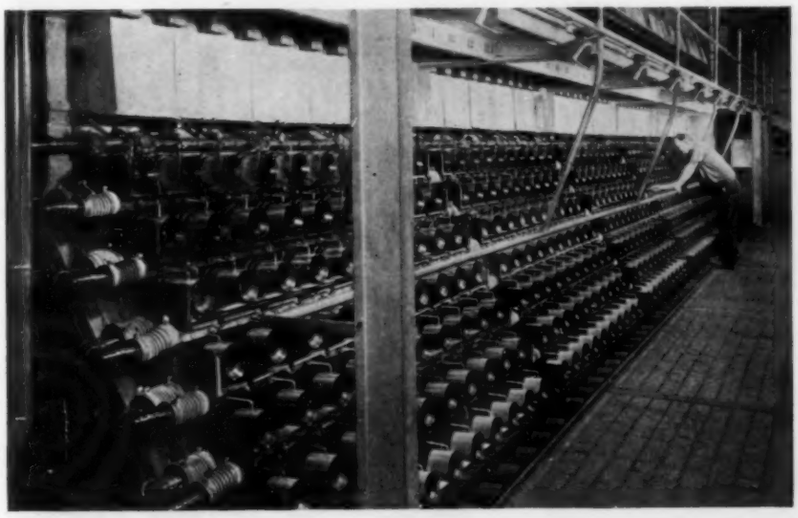
Later, to protect its own research against possible developments by others, Industrial effected a cross-licensing agreement with the New Process Rayon Co., owner of the Furness patents under which a continuous cupra-ammonium spinning process had been worked out as described in *Chem. & Met.*, June, 1932, p. 326.

The continuous cupra-ammonium process had demonstrated that one type of rayon could be made without the need for processing in packages, but cupra-ammonium is a relatively simple yarn to spin and viscose is quite another matter. Thus, from the onset of the continuous viscose development there was considerable scepticism outside the Industrial organization, for viscose requires a complex gas exhaust system, corrosion is a much greater problem than with cupra-ammonium, and several additional operations are required.

### Formation of Machinery Firm

Nevertheless, the work progressed encouragingly and in August, 1936, the Rayon Machinery Corp. was formed as a wholly owned subsidiary of Industrial. George P. Torrence, for many years president of Link Belt Co., was placed in charge to carry the work to the successful conclusion now evident at Painesville. That the difficulties indicated were overcome, with the development of a cleanly designed machine of no great complexity, is a tribute to both these organizations for their vision, preseverance and ingenuity, as well as to several of the suppliers of parts, particularly the American Hard Rubber Co., which had to develop special corrosion-resisting hard rubber compositions, deliver the largest single hard rubber order recorded in any two-year period, and produce some of the largest hard rubber moldings ever made.

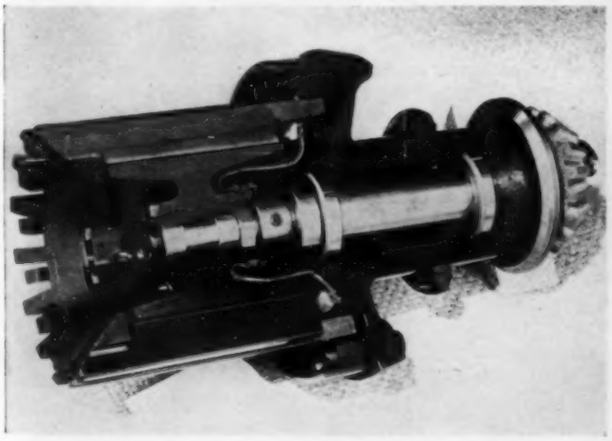
The heart of the new process is a patented reel which accomplishes the separation and continuous advance-

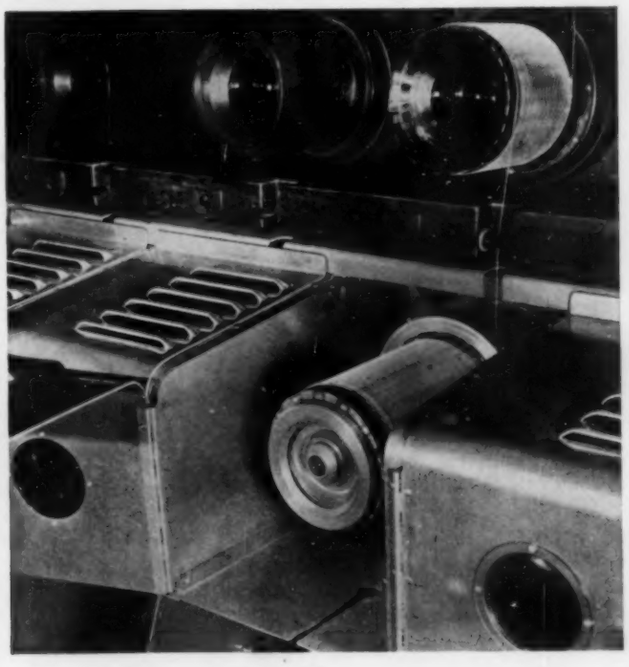


Above—Intermediate operating level of experimental continuous spinning machine which operated for two years in the Cleveland plant

Below—Section of Bakelite reel showing independently centered cage members

Right—Hot-water-heated aluminum reel for drying continuous-spun yarn



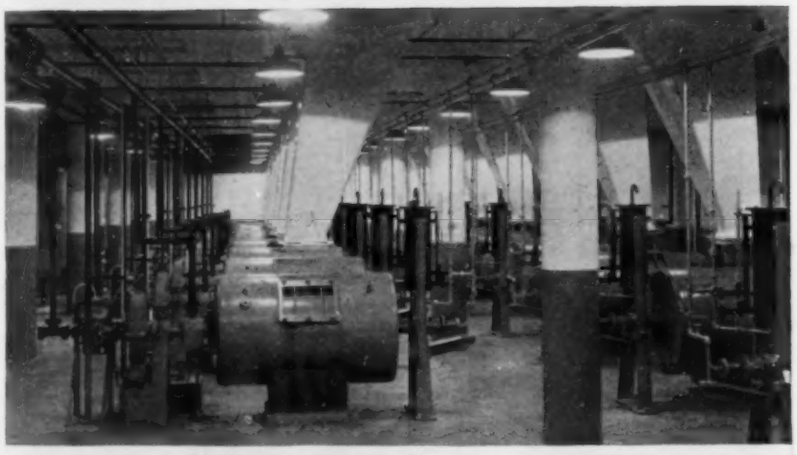


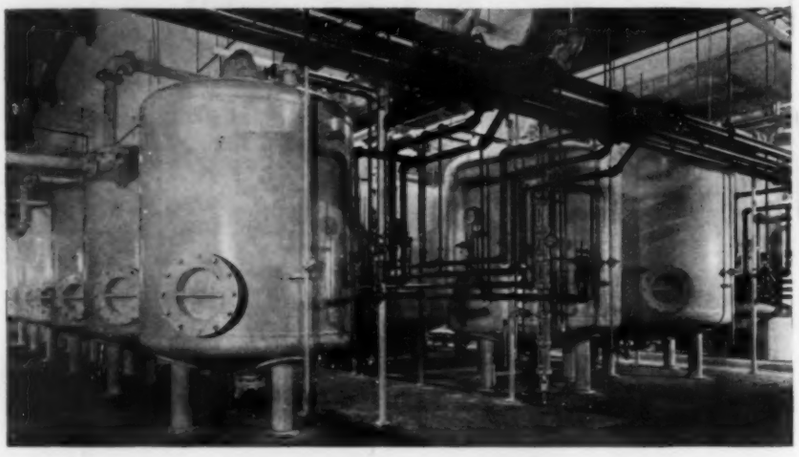
ment of the turns of yarn as they wind on the reel from the preceding step. In the new process ten of these reels are used for each spinning position —a total of 96,000 for the plant. Unlike other reels designed for this or comparable purposes, the reels for the continuous spinning machine are made up of two rigid, open-ended cages, set one within the other. Each cage is made up of a cylinder of fingers and as the reels are assembled, the fingers of one are between the fingers of the other. Supported on a single shaft which is gear driven from within the machine, and operating together so as to look much like a single ribbed cylinder when in motion, the cages do not, however, rotate about the same center. Hence, in rotation, the relative motion of the alternate fingers forming the reel surface causes a thread led on to the reel at one end to advance automatically until it passes off the opposite end to the reel next in the sequence. Each reel holds some 40 turns of yarn which advances over its surface at the rate of about $\frac{1}{8}$ in. per revolution, giving the appearance of a screw thread. Thus in very compact form a large amount of the yarn can be subjected to the action of the treating solutions while at the same time it is stretched or prevented from shrinking, as desired.

### Construction of Machine

Now that the principle of the reel has been indicated, it is possible to describe the spinning machine as a whole. In cross section, the frame of the machine is a structural steel A with a platform for access to the reel drive gearing on the cross bar of the A. Each machine comprises 100 spinning positions, with 50 spinnerets, their pumps and their respective trains of reels on each side. Operation is from three levels, the entire machine being approximately 20 ft. in height. Above the peak of the A-frame is the coagulating bath into which the spinnerets dip, the whole inclosed in a ventilated hood. Access to the spinnerets is secured from a working platform on each side which also permits the operator to reach the Zenith gear spinning pumps, each set of 50 being driven from a single shaft tied into the main machine drive.

Above the coagulating bath and aligned with each spinneret is the first of the reels, made of Bakelite to withstand the attack of the bath. The wet and incompletely coagulated yarn is drawn from the bath and winds on the reel at the rate of some 70 meters per minute. Since this first reel is slightly flared toward its discharge end, the yarn is stretched somewhat in its passage over the increasing diameter. It then winds off and passes down through a tube to the intermediate working level, where it passes in succession over the next eight reels, which are accessible from this level, set in cascade fashion so that the discharging yarn from each reel is able to drop almost vertically over a guide on to the reel below. These reels also are of Bakelite, but of constant rather than flaring diameter.





**Row of steeping presses in Industrial's new Painesville plant**
**Xanthating churn room on the second floor of the chemical building**
**Battery of welded viscose ripening tanks in spinning building cellar**

On this level each of the reels is set over a hard rubber trough and the lip of each trough is formed into a tube for conveying the solution which is to be distributed over the row of reels next below. Troughs are 10 reels long and are connected together by flexible joints. Bent glass tubes are provided to drip the solutions on to the reels near their discharge ends so that, owing to a slight upward tilt of the reel shafts, the solution gravitates back along the yarn, dripping finally into the trough below.

### Treating the Yarn

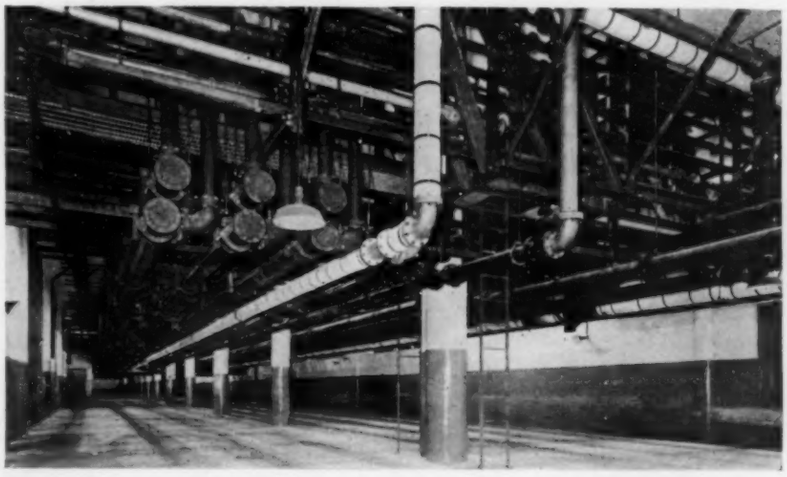
The highest of the reels on this level accomplishes the first acid washing operation after coagulation. Passing downward from reel to reel, the yarn is then washed, again, with water, treated with desulphurizing solution, washed, treated with bleach, washed, lubricated for improving the later handling qualities and finally passed over an unsprayed reel which whirls off excess solution. This last reel may later be employed for additional treatment of the yarn. The tenth reel, which is made of aluminum and heated with circulating hot water for drying the yarn, is reached from the level below. All of the reels in one train are driven from a single shaft paralleling one side of the A-frame. An ingenious type of neoprene seal protects the individual reel shafts so effectively, it is claimed, that trouble is never encountered from solutions dripping back along the shafts.

A single motor drives all reels and spinning pumps on each 100-spinneret machines.

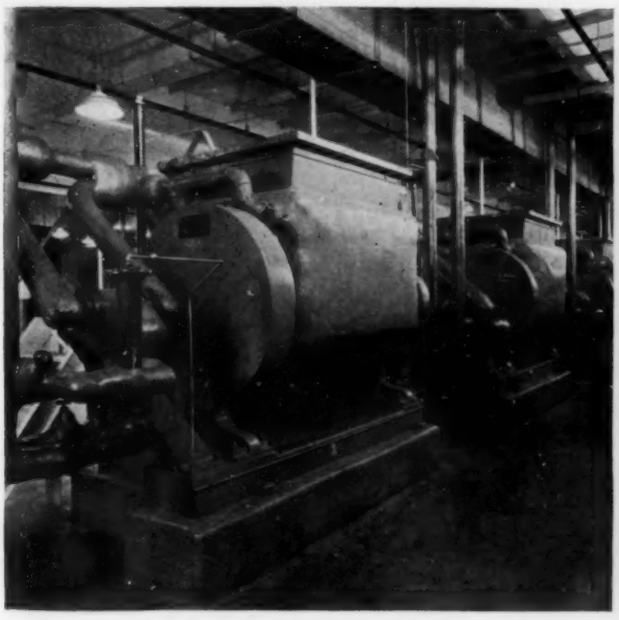
### Drying and Twisting

Below the solution-treating section is the main spinning room floor which serves as the lowest working level for the machines. Here are the drying reels, each of which is individually housed in a box-like structure to retain the heat and control air currents. The dry yarn discharged from these reels is ready to twist and this is accomplished by winding on to vertical bobbins supported on spindles turning at 9,000 r.p.m. The entire bobbin reciprocates vertically within a stationary cap over the lip of which the twisting yarn balloons as it winds on to the bobbin. A separate motor operates through a variable speed drive to run the spindles and traverse motion independent of the spinning machine drive so that the twist can be altered if desired. Normally, the twist put into the yarn is about 3 turns per inch. Twister bobbins hold 2½ lb. of yarn and when handling 150 denier yarn at 70 meters per minute, require about 16 hours for filling. The doffing operation is

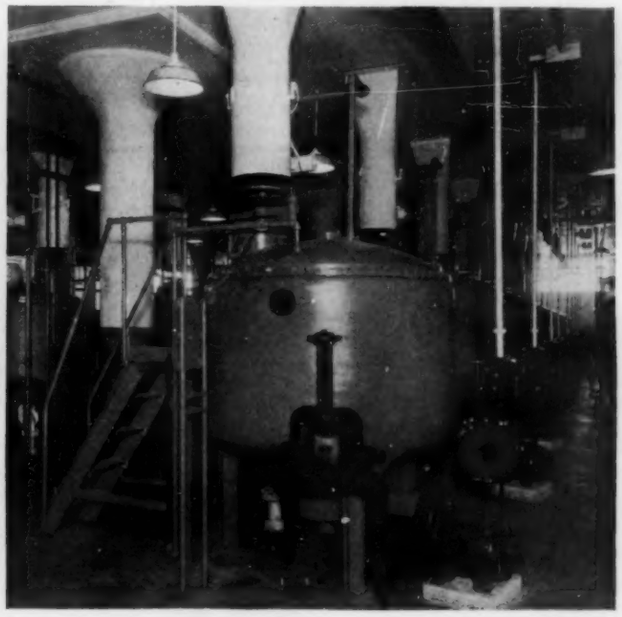
Pipeline gallery serving the continuous spinning machine room



Shredders for disintegration of pulp sheets from the steeping presses



Special agitated equipment for dissolving xanthate in dilute caustic soda



facilitated by an ingenious device located beside each twister position—a small air-operated suction pipe leading to a waste box, into which the yarn is fed at all times when it is not being wound on the twister bobbin.

The foregoing has described the new spinning machines in some detail, but they are by no means the only novel feature in the new plant which has been built to house them. Situated a few miles east of Painesville on the shore of Lake Erie, the plant totals 14 acres of floor space, the principal buildings including: the office building, power plant, laboratory, chemical building and the plant proper which houses the viscose ripening cellar, the spinning machine solution preparation department, the spinning room, the winding, storage and shipping departments. In addition, this building includes the employee quarters, such as locker rooms, hospital and cafeteria. The entire plant is air conditioned and, except in the office building, is windowless in the usual sense of the word. Instead of windows, walls and monitors of the building have been constructed with Owens-Illinois glass brick panels, 371,000 such brick having been used to produce what is believed to be the largest glass brick installation to date. Excellent natural lighting is thus secured, together with much better heat insulation than could be obtained with conventional windows.

### Plant Design Features

All parts of the plant have been designed with the greatest of care for maximum efficiency. The new power plant with its three pulverized-coal-fired boilers, and its three 5,000-kw. bleeder turbo-generators, supplies power, heating and process steam. Condenser water is available in unlimited quantities from the adjacent lake which also provides process water to the filtration plant at a rate great enough to meet the residential needs of a city of 450,000 people. The refrigerating installation has a capacity of 1,800 tons of which 1,500 tons is required for air conditioning, which is handled on a zone basis to take care of the varying requirements of different departments.

So far as possible, the plant has been laid out to permit gravity flow. This is particularly true of the chemical building, a four-story structure which includes an inclosed rail-car trestle on the second floor level, from which tank cars can be unloaded by gravity to the storage tanks below. On the fourth floor of this building are the steeping presses, caustic soda storage tanks and Baker-Perkins shredders. Handling of the pulp sheets to the presses and from the presses to the shredders is accomplished with overhead monorail carriers which are also used in dumping the alkali cellulose crumbs from the shredders to the ripening room. On the second floor are the jacketed welded steel xanthating churns or barratts to which the ripened alkali cellulose is chuted by gravity. The churns in turn discharge through chutes to the Patterson dissolvers on the first floor in which the xanthate is dissolved in additional caustic soda solution. Also on this floor is an installation of Cerini dialyzers of sufficient size to recover the bulk of the waste caustic from the steeping presses, and a group of tank car storage tanks.

From the xanthate dissolvers the viscose flows by gravity to the welded steel ripening tanks in the cellar beneath the spinning room. Indeed, the entire plant is notable for the extent and quality of the welding that has been used in the fabrication of equipment. During the ripening period, the viscose receives three filtrations in plate-and-frame filters, after which it is forced by air pressure to individual filter presses associated with each spinning machine. By this means, candle filters at each spinning position are dispensed with and yarn breaks almost completely eliminated.

### 12 Miles of Rubber Pipe

Also in the cellar are the coagulating bath evaporators and the pumps and make-up tanks for the various spinning machine solutions, including the coagulating bath, dilute acid wash, desulphurizing and bleach solutions, and the yarn lubricant. Extending through the cellar is a pipeline gallery serving all spinning machines which contains a considerable part of the 50 miles of pipe used in the plant. Of this quantity some 12 miles is hard rubber, ranging in size from 1½ to 8½ in. Slots at intervals through the spinning room floor above the gallery serve to carry pipes to the individual spinning machines.

Above the cellar, the 3½-acre spinning room contains the first group of the 96 spinning machines, of which the last is to be installed and in operation by March, 1939. Adjacent to the spinning room, and served from it by hand-propelled trucks carrying the filled bobbins of twisted yarn, is the winding room where the entire output of the plant is coned on Universal winders. This department communicates directly with the storage, packing and shipment areas which are served by a spur connecting with the New York Central, Nickel Plate and Baltimore and Ohio Railroads.

General view of Industrial Rayon's new continuous viscose spinning plant at Painesville, Ohio

# Disposal of Distillery Slop

*H. P. BASSETT, Chemical Engineer and President of Meigs, Bassett & Slaughter, Inc., of Philadelphia, tells the story of slop disposal by heating, filtering and evaporating. This is another in a long list of chemical engineering achievements, where a worthless waste was changed to a useful byproduct.*

BEFORE THE PROHIBITION ERA, the distillation of grain was carried out in small units widely distributed. A 100- or 200-bbl. distillery was considered large. And, at this capacity, it was possible to dispose of the waste grain and slop by feeding it to cattle in sheds or feed lots adjacent to the distillery. In addition, the neighboring farming district furnished roughage such as fodder, hay, etc., which is essential when feeding stock in this manner.

Some of the larger distilleries installed equipment for screening and drying the grain for sale and fed the liquid portion with roughage to the stock. Others were allowed to run this liquid portion into the nearby streams as they operated only during the fall, winter and early spring seasons when the streams were full.

However, due to the laws passed by several states concerning stream pollution and the establishment of large distilleries where 10,000 to 25,000 bushels of grain per day were ground, it was impossible to dispose of this waste as in pre-prohibition days. The distillers were forced to install screens, dryers and evaporators to take care of the waste even at a loss on operation.

Evaporation of the screened slop presented a difficult problem because of suspended matter coming from the presses, which coated the evaporator tubes reducing their efficiency. At that time, slop could be evaporated to only about 30 per cent solids.

Some improvements were made on this method of handling—notably that of Hiram Walker & Sons, Inc., Peoria, Ill.—by using solid basket centrifuges. This required considerable labor and power but enabled them to bring their clarified slop to 50-55 per cent solids in evaporators, where the evaporation could be done more economically than in dryers.

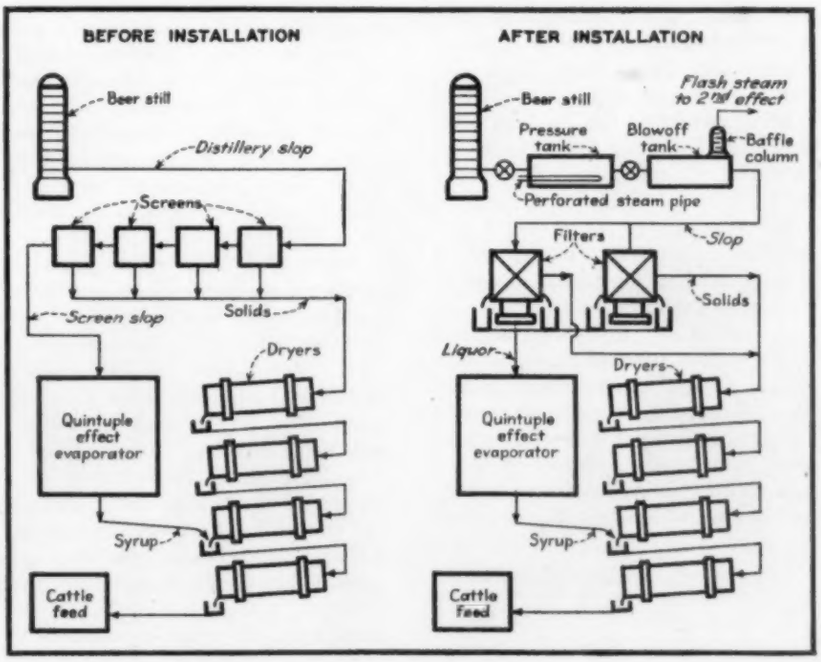
The writer was called by the American Distilling Co. to find the best method for recovery of this slop. He developed a method of preheating the slop after it came from the beer still to coagulate the solids and make them filterable.

It was found that if slop from Bourbon whiskey were heated momentarily at 35 deg. C. with live steam, the suspended solids coagulated and would filter quite readily in any type pressure filter, such as plate and frame, Kelly, Sweetland, etc. The yield was about 18 lb. solids per bushel of grain handled out of a possible 22 lb. The filtrate was clear and evaporated without difficulty to 60 per cent solids. Pure grain could be dried in press to 55 per cent moisture.

In both cases, the dryers were relieved of a considerable load. In the case of rye whiskey mash, it was found that the pressure had to be carried to 55 lb., where it could be handled in the same manner. It turned out that flash steam from these heaters could be used in the evaporators. In all, the process required only about 7 per cent more steam than had previously been used in evaporating only one-half the liquid slop and drying the total amount of screenings.

In the old method, the screenings after going through press ran 80 per cent moisture, while the press cake from the new method ran 55 per cent moisture. The overall recovery was raised to 21½ lb. out of a possible 22½ lb. of feed per bushel. The equipment required, outside of the evaporators, was inexpensive and the upkeep quite small. Presses and screens which were always giving more or less trouble entailing a large expense in upkeep were replaced. This method of operation gives a high yield of good quality feed since all the fats and proteins of the grain are retained.

**The slop disposal system shown at the left was that of the American Distilling Co. prior to the installation of the Bassett system. A considerable saving in power consumption resulted from the changes shown at the right**



# Training Tomorrow's Leaders

*Although chemical engineering courses aim to prepare for technical careers in production, research, and engineering, the record shows that ultimately a majority of graduates become engaged in administrative and executive work. Pointing out that the reasons for this are inherent in the nature of the profession, the authors discuss how present training might be improved to meet future requirements*

C. M. A. STINE *and* CHAPLIN TYLER

*Vice-President and Assistant Director of Public Relations*
*E. I. du Pont de Nemours & Co., Inc.*
*Wilmington, Del.*

IF THERE IS ONE NEED more urgent than others in all fields of endeavor, it is for administrative leadership; for creative leadership or the shaping of policy. Of tactical leadership we see no serious deficiency. Standard engineering courses, followed by such well-rounded experience as is afforded by the larger corporations, provide the necessary foundation for a professional engineering career. It is therefore with respect to administration that we speak, and more particularly with respect to the administration of the industrial enterprise.

To claim that the administrative art can be taught is to presume a good deal. We do, however, believe that it is practicable to design a college course which points particularly toward eventual administrative responsibility. The foundation of such a course might very well be chemical engineering. Furthermore, we believe that a chemical engineering course, leading merely to the bachelor's degree, for the young man who is not intending to specialize subsequently in professional engineering can be made one of the most useful and suitable preparations for any one of a large number of varied means of earning a livelihood.

A careful and thoughtful analysis of the various types of situations with which a young college graduate may be confronted in the sort of a world that we live in today will afford a very good case for the value of as broad and varied training in applied science as his time will permit in connection with the usual bachelor's degree. If a business career is contemplated, then we would be more specific and say that a training in chemical engineering can be one of the most valuable types of foundation which may be laid. In order to illustrate a few of the varied applications of this type of training, let us discuss more specifically *chemical engineering* training.

We suggest chemical engineering as the answer to the question, "Why engineering as a foundation?" because all industry has its roots in applied science, and of the various branches of applied science, chemical engineering is the most interwoven with manufacturing. To qualify as a chemical engineer implies more than superficial knowledge of materials and energy and their transformations. Although the chemical engineer regards a knowledge of machines and structures as highly important, he regards such knowledge as a means to an end, not an end in itself. The chemical engineer is, or should be, characteristically an inquiring and research-minded person, unfettered by tradition.

Another thing that characterizes chemical engineering training is the opportunity it affords the young man to find himself quickly in industry. If he has an aptitude for invention and investigation, there are the chemical, the physical, and the engineering laboratories; if he has an urge to apply his knowledge of chemical engineering principles to problems of immediate practical importance, there is more specifically the engineering department with its work of design, construction, and improved operating practices; if he craves action with all that the word implies, there is the factory, in which he can start as an operator or operator's helper. Chemical engineering training combines a high degree of utility with a broad knowledge of the fundamental

Abstract of a paper presented at the Philadelphia meeting of the American Institute of Chemical Engineers, Nov. 9–11, 1938, under the title "Training Tomorrow's Industrial Leaders."

sciences of chemistry, physics, and mathematics.

But let it not be thought that these three outlets for the chemical engineer—research, engineering and production—represent a horizon of activity. Far from it. They represent only the logical immediate activities which constitute a direct extension of academic training into the field of industry. Schools do not turn out chemical engineers; they prepare for the profession of chemical engineering.

That there is an outlet for the chemical engineer in work other than purely technology, is well known to the reader. In a quantitative sense, however, the subject is obscure. In attempting to develop further information, a sample comprising 400 active members of the Institute was taken from the Directory of Members for 1938. It was found that 244, or 60.5% held positions in an executive or administrative capacity; that 113, or 28.2% held positions in a technical or semi-technical capacity; and that 45, or 11.3% held non-administrative positions in teaching.

The question might be put quite specifically: What advantages accrue from a chemical engineering training and a subsequent period of technical practice, say not less than ten years practice, which especially condition a man to cope with problems of industrial administration? In order to answer the question adequately, suppose industry be considered from the functional viewpoint.

The chief functional activities of industry might be grouped as follows:

1. Research, development.
2. Production.
3. Marketing.
4. Accounting and finance.
5. Industrial and public relations.

It is not necessary here to discuss the relation of the chemical engineer to research, development, engineering and production.

As to the marketing function, many opportunities for the chemical engineer exist and new ones are opening up. Recently the chairman of a company in the air conditioning industry remarked that the rate of growth of his organization was limited largely by an ability to train engineers for the sales organization. Several oil companies advertise that their lubrication experts will survey factories in order that lubrication service may be improved and costs reduced. These experts are engineers, yet their major responsibility is to sell goods. Similarly, chemical companies employ engineers and chemists to sell and to service the application of such products as dyes, explosives, plastics, rubber chemicals, and solvents.

The relation of the chemical engineer to the accounting function is exemplified by the following case problem in cost accounting.

In the catalytic reaction between carbon monoxide and hydrogen at high pressures and under certain controllable conditions, a mixture of alcohols and other compounds is obtained. It is comparatively easy to find the inclusive cost of the mixture of crude methanol, propanol, isobutanol, and alcohols higher than isobutanol. But it is not so easy to find the cost of the constituent refined alcohols. The chemical engineer knows, however, that a pound of higher alcohols requires nearly three times as much raw material as a pound of methanol, therefore the distribution of crude alcohol cost between refined methanol and higher alcohols would be adjusted in accordance with this factor.

What types of training will serve the needs of the man who desires to develop along research engineering lines; or the man who is going to interest himself in production, or sales; or the chap who may eventually be interested primarily in administrative problems? In our thinking regarding chemical engineering training, we wonder whether we sub-consciously envisage a curriculum ideal in plan and regimented in execution? If so, we wonder whether we might not expect to obtain much better results by differentiating among the better types of schools offering a course for chemical engineering training, finding perhaps on the one hand a school whose objective it is to develop *research* chemical engineers, perhaps a second type of school with the objective of developing primarily engineers well equipped for work along the lines of *design* and *production*, and perhaps a third type of school which has in mind not specifically the equipping of any of its graduates for special professional work in engineering, but desires instead to use engineering courses, and particularly chemical engineering, as a method of attaining a broad acquaintance with the problems of modern business practice.

We are quite aware that the functional approach in education is a controversial subject, and that the typical freshman is little aware of his aptitudes, if any. We believe, however, that entrance examinations could be devised which would differentiate reasonably well among these three types. Let us recognize that regimentation and standardization in engineering education is dangerous and atrophying, and individualism is healthy and progressive.

Instead of attempting to determine whether economics or other subjects should be required courses, we propose that we recognize that there should be marked differences in curricula. Thus, the course for research chemical engineers would be strong in advanced mathematics, organic chemistry, and experimental methods; the course for design and production would be strong in machine design, electrical engineering, power generation and transmission, properties of materials, and safety engineering; the course for administrative engineers would include an extended course in the economic problems of chemical engineering, the history of chemical industry, and a study of industrial and public relations.

Functional differentiation could be carried through to graduate courses. For example, in the course for chemical engineering administration, a suitable subject for advanced study leading to the doctorate might be, "Human Wants as Affected by Chemical Discovery." Today it is just as important that fallacies concerning technological advance be dispelled as it is to develop new things and to produce things.

In conclusion, may we point out that the nation's progress, welfare and security depend upon three things: First, the ability to administer the natural and human resources of the nation for the greatest good of the greatest number of people; second, the material resources of forest, mine, land and sea; third, the character, as well as the number of the human resources which, in our case, is represented by the figure of 130 millions of people. Since the notable characteristic of our modern civilization is technologic advance, it follows that the burden of administration should fall upon those who have created the advance. Here indeed is a challenge and an opportunity; and for the mantle of tomorrow's leadership, we nominate the chemical engineer.

# What Patents Mean to Industry

***With the patent system again under fire from certain quarters it seems appropriate that chemical engineers re-examine the influences it has had on the development of their own and other American industries. Dr. Jewett, who is a member of the Patent Committee of President Roosevelt's Science Advisory Board does this here and replies to some of the current charges against the system.***

**FRANK B. JEWETT**
*Vice-President*
*American Telephone & Telegraph Co.*
*New York, N. Y.*

AS ONE LOOKS BACK over the history of the nation he cannot, I think, escape the conclusion that the patent system has been a powerful force in our growth from an insignificant agricultural and trading federation to the most powerful industrial nation on earth. It is a force too powerful in what it has done and in what it can still do to be tampered with lightly.

The present attacks on the system are nothing new. Periodically since the Constitution was adopted and the first patent law under its provisions written, attacks against part or all of it have welled up. Usually they have coincided, as in the present instance, with a period of great industrial activity in a field or fields where widespread public interest was aroused and where much that was new and patentable came into being. Sometimes the agitation for radical change or complete abolition was advanced as a means of curing some undesirable consequences resulting from operation of the system under conditions not theretofore encountered. Frequently when the smoke of battle cleared in a Congressional investigation, it was found that the attack was instigated by some group whose freedom was abridged by patents and whose immediate self-interest would be served by their abolition or drastic curtailment.

Such of the present attacks as are directed toward curing weaknesses of the system brought to light through new conditions are entirely legitimate and desirable. When, however, the attack is aimed at the emasculation, if not the destruction, of the patent system as a matter of public policy it seems to me, to use a slang expression, to be the ultimate of "eye wash." If such attack is motivated by malice, by an assumption of future human behavior which discards all past experience or by reason of some special narrow present interest, I can understand it even if I do not think it good public policy. Otherwise it seems to me the result of sheer ignorance of what basically the patent system was set up to accomplish.

It is conceivable that everything we now have through fundamental science research might have been produced in the absence of a patent system—likewise a small part possibly of the applied science inventions. It is hard, however, to imagine that most of the inventive work or any of the great industrial undertakings would or could have been undertaken without the stimulus and protection afforded by that system. The risks would have been too great to be faced and any substantial urge to pioneer on a large scale would have died at birth.

Now, with great laboratories requiring huge annual expenditures, the necessity for patent protection is greater than ever. Nor is the necessity confined to the great industries which are required in many cases because the things they do can only be done on a gigantic scale. Those that are now established, though hampered, could probably live even though they might not develop if the patent system were abolished, if compulsory licensing were in effect, or if a sliding scale patent tax were imposed.

To the independent inventors and the small or new industries, maintenance of the essential features of the present patent system are imperative if they are to live at all and prosper. The things about patents which are most inveighed against in big industry are the very ones they most require. They afford the inventor of a meritorious thing opportunity to get maximum reward for his contribution, while they give to the small or new industry the weapons by which to exist and develop.

To do anything which tends seriously to impair or threaten the basic concepts of our patent system on the assumption that by so doing we will further the interests of the individual of industry, or of society is to force a return to the philosophy of secrecy and to set our feet on the road to industrial suicide. Modern industry,

Presented at the American Institute of Chemical Engineers meeting in Philadelphia, Nov. 9–11, 1938, under the title "The Influence of the Patent System in the Development of American Industry."

which is based on applied science, is too vast and complicated to live in a world ruled by the dictates of secrecy. To live and expand it must have full access to a common store of information.

### Are Mass Holdings Bad?

When all is said and done, the present beating of tom-toms is mostly about the alleged iniquities inherent in ownership by one agency of many patent rights. On this score I firmly believe that so long as we have a patent system and a virile industry based on the application of modern scientific knowledge, the group acquisition of patent rights is as necessary and inevitable as that capital should be provided or men employed.

The iniquity or anti-social character, if any, is not in the ownership of a multitude of patent rights any more than it is in the single ownership of a multiple of many other kinds of property. The right to exclude others from the unauthorized use of one's property, be that property large or small, is a common characteristic. It is not this or the size of one's holdings, which may be small for a truck garden or city dwelling or large for a Texas cattle ranch or a large-scale lumbering operation, but the *use* we seek to make of our property which may cause it to become a nuisance "contrary to the law or mischievous to the state" as the James I Parliament said.

Part of the difficulty, I surmise, arises from the fact that each patent is known to be a monopoly of some sort—most people think it a positive monopoly to do the thing described rather than simply a right to say who can or cannot do that particular thing. In consequence the assembling of such rights together must seem to them of necessity to create a particularly abhorrent kind of monopoly. Actually anyone who knows what patents really are know that a business monopoly built up on them alone, be they one or many, is the most fragile and precarious monopoly that can be founded on property.

But while patents alone are a fragile foundation on which to erect lasting successful industries, this is not to say that they have not and do not now play an important part in the creation and maintenance of them. As fundamental science research has developed new stores of usable knowledge and applied science has sought to put it to work, the difficulties and expenses of starting new industries have multiplied. For men to risk effort and large sums of money in such fields there must be some reasonable guarantee that well through the incubation period at least there will be protection against pirates and death-dealing competition.

Although they may have no very direct bearing on the past or present relationship of the patent system to the development of American industry, I cannot resist the temptation of saying a few things about certain aspects of the system about which there is at present a plethora of destructive criticisms—all of them heated and most of them, to my way of thinking, what the boys call "tripe." My reason for bringing them in is because of a feeling that if they can be sufficiently "debunked" we may avoid making a costly mistake in some of the legislation for modification of the patent system which has been proposed. I should like to help do this.

### Unused Patents

First and foremost are the horrendous hordes of unused patents which should be put to work. Parenthetically, when they appear as a large number of them do, in the possession of industry, particularly if it is large industry, they are always "suppressed patents" and are infinitely more horrendous than the common garden variety.

That the number of unused patents is large goes without question. That any considerable number of them are of much, if any, value I doubt and that any really valuable ones are "suppressed" I just simply do not believe. The explanation is that any one possessed of a valuable patent has every reason to exploit it before its life blood runs out and dare not delay the exploitation for fear his competitor will get a better patent. I have no doubt that there are now as there always have been valuable patents which are not in use because the art to which they apply is not yet far enough advanced to permit it. This is not suppression—all the will in the world could not force use under the conditions.

Despite the fact that I have made diligent inquiry over the years I have never been able to locate a suppressed patent nor have I ever found any one who could cite an authentic case of suppression.

The plain truth of the matter is that a large part of unused patents are worthless things which the inventors insisted on patenting and on which the Patent Office had to issue patents because the ideas presented were technically new and novel—the Patent Office does not pass judgment on the utility of the patents it grants. They are not and never were anything anybody would use.

### Pending Changes in System

In conclusion I want to say a word about industry's interest in certain changes in the patent system that are now being discussed. Fundamentally the changes that have been suggested and which seem to me most desirable, if they can be worked out, are of two kinds. One concerned with Patent Office procedure seeks to increase the presumption of validity of patents as they emerge from the office. The other has to do with legal proceedings and seeks to expedite, make more certain and less costly, litigation arising out of the employment of patents.

As things now stand, the situation in both categories is far from satisfactory. Of the two, the one of presumptive validity is by far the more important since it concerns the base of the whole structure and affects all patents. Nothing concerned with the operation of patents really starts until the final action has been taken by the State in the Patent Office. Everything thereafter is influenced by the goodness or badness of work in the emitting body.

If it were humanly possible for the Patent Office to issue nothing but patents which would be adjudged valid by any test that could be applied, a large part of litigation would disappear and the path of inventors and industry would be made more certain and expeditious as well as less costly and vexatious.

Of the court changes proposed all that need be said is that principally the one which seems to me most desirable is that which would establish a single Court of Patent Appeals to supplant the present Circuit Courts in the hearings of patent appeal cases. From the standpoint of the users of the patent system the provision of a single court of last instance, staffed by judges specializing in the highly technical subject of patents has much to commend it.

As to both matters, industry has a large stake in forwarding anything which will make the operation of patent property more certain and less of a gamble.

# Why We Report to Our Employees

***One reason is that better teamwork is possible when every player knows all the plays. Another is that by telling others about company affairs, in language they can appreciate, we learn more about them ourselves.***


**EDGAR MONSANTO QUEENY**

*President, Monsanto Chemical Co.*
*St. Louis, Mo.*

TO THE EMPLOYES OF THE MONSANTO CHEMICAL COMPANY:

Let us sit down together and talk for a little while about our business.

You probably know that it is part of my job, as president of our Company, to make a report every year to our Stockholders.

I have just finished making that report for the year 1937. If you would like to see a copy, simply write me for it and I will send it to you. And now I want to make a similar report to you who work at Monsanto, just as if I were talking to you.

Probably you have wondered:

**"WHO ARE OUR STOCKHOLDERS AND WHY IS IT NECESSARY TO REPORT TO THEM EVERY YEAR?"**

At the close of last year, there were 8,963 Stockholders in our Company . . . men and women from every state and many foreign countries . . . life insurance companies, trust estates, and other investment and savings organizations . . . people and institutions who have enough confidence in our Company and its officers to invest their money with us.

It is their money that bought our land, buildings and machinery. They supply the money needed to operate a business as big as ours. Thus, in effect, you and I are all working for them.

Naturally, since the Stockholders are the people who are employing every one of us,

LAST SPRING when Monsanto published a special "Employees' Edition of the Annual Report for the year 1937," we printed enough copies to supply our employees here and abroad and then allowed a few hundred extra for the files. Much to our amazement, requests for from one to one hundred copies began coming in from stockholders, customers, competitors and executives in all lines of industry. So the Employees' Edition went into a second printing, and then into a third, until now, at the end of the year, we have only a few file copies left out of a total press run of 30,000. Despite all this interest expressed in our report, I see nothing unusual or sensational about the whole procedure. Certainly we cannot claim it as an original idea. However, since the editor of *Chem. & Met.* has asked for this article as part of his series on public and employee relations in the chemical industry, I shall be glad to review some of our reasons for putting out this and subsequent reports to our employees.

A basic philosophy of Monsanto management is that an organization is a team and the company's officers and key operating executives are the coaches. It would be a strange football team in which some members knew the plays to be made and under what conditions certain strategy should be followed and others did not. A team properly trained and properly directed can function on the playing field much more efficiently than one in which the coaches and quarterbacks have not synchronized their thinking.

There is a parallel in industry. A company in which the plant, laboratory and office forces are kept informed of the company's status and the reasons behind certain operating policies decided upon by management, can function much more efficiently on the playing field of competition. That is why we published the employee edition of the financial report. We wanted our employees to know just as much about the company that had employed them as did the stockholders who had invested money to provide the working capital of the organization.

To us, the employee edition was simply an item in a program of curtain lifting that has been going on in Monsanto since 1928—a program of curtain lifting launched to give stockholders and the general public, as well as the members of the organization, a picture of the financial stand-

ing of the company, its sales volume, its tax problems and all other factors that are daily routine in any business organization, whether it be large or small.

First of all, it has been only recently that financial statements to stockholders have been written in a language understandable by any but the financially minded. The annual reports of most corporations were filled with vague, complicated and involved statements on operations and with balance sheets that none but an expert accountant could understand. We recognized this weakness in our own stockholders' report in 1928, and an examination of our yearly statements from then to the present time shows the evolution of simplification, interpretation and down-to-earth treatment. Year by year we have given to our shareholders more detail, a more intimate picture of their company and its status.

At the same time, over these years, we have attempted through the medium of *Monsanto Magazine*, a publication distributed to employees, shareholders and customers alike, to keep our employees informed on the inner workings of the company and the reasons back of the policies that govern our operations.

With this experience, it was a natural and logical step to prepare a special edition of the annual financial report in which would be the answers to the questions in the mind of the man in the plant, the chemist in the laboratory and the stenographer in the office. That is why we published the employees' edition. And we were surprised to find that many of our key men wound up with a lot better knowledge of the company after reading the report.

It is difficult to know how valuable a report such as this really is. I have been asked this question hundreds of times. No doubt many employees read it thoroughly and obtained something from it. On the other side, I am sure many employees read it through quickly and obtained nothing from it, and I know some didn't even turn the pages or open the envelope which brought the report to their homes.

The effect of anything like this is intangible. If only ten per cent of our personnel obtained from this first edition a clearer picture of the company and their relationship with it, the effort was very much worthwhile. Next year possibly another ten per cent will learn something from it and as the years pass, eventually maybe half will have a better understanding of industry and the way in which their progress and the welfare of their families is interlaced with it. Education is at best a slow process.

One report such as that published last spring is like the first blow of a woodsman's ax. The first impression doesn't register very deeply. It takes a steady stream of blows to make a marked impression. But the growing impression gives a growing reaction.

We have followed through in 1938 with a six months report in September and a nine months report in November—both published in *Monsanto Magazine*. In 1939 we plan even greater simplification in treatment and will issue regular quarterly reports.

Summing up the comment and reactions we have obtained, and looking at it months after publication, I believe most definitely that it is advantageous to any company to make a special report to employees as well as a special report to stockholders. A stockholders' report is used mainly by market analysts in assembling their advice to investors. Market analysts want cold figures and statistics. What they must have to reach their conclusions doesn't have much of value and interest to the average employee. He wants something that he and his wife and family can understand without going to a banker or lawyer for advice. In short he wants his own version and based on our experience we have no hesitancy in recommending some sort of specialized treatment by any management that wishes to keep its employees better informed about company matters and policies.

## ★ EXPLANATORY BALANCE SHEET ★

Monsanto Chemical Company and Subsidiary Companies
As of December 31, 1937

### WHAT WE HAVE (ASSETS)

| | | THIS COLUMN SHOWS how much of each item of our assets is invested per Employe. It is this investment which makes each Employe's job possible |
|---|---|---|
| Cash in banks in principal financial centers and in towns where our plants are located. This amount normally equals cash required for about a month's operation | $3,056,127.56 | 580.13 |
| Securities to be used to pay for replacements and future construction | 4,027,805.36 | 764.58 |
| Customers owe us for goods we sold them | 2,885,546.56 | 547.75 |
| Inventories of finished goods and raw materials on hand | 7,577,190.12 | 1,438.34 |
| Land on which our plants are located | 1,731,398.48 | 328.66 |
| Buildings which house our offices, laboratories, service departments, power plants and manufacturing departments | 7,661,284.17 | 1,454.31 |
| Machinery and manufacturing equipment | 24,336,903.52 | 4,619.76 |
| Phosphate mines in Tennessee | 417,794.65 | 79.31 |
| Bills paid in advance | 212,549.40 | 40.35 |
| Patents, processes and good will — since their value cannot be calculated, they are carried at only | 1.00 | |
| Due from employes, on Monsanto stock purchase agreements | 171,494.32 | 32.55 |
| Miscellaneous investments and deposits with insurance companies | 663,824.14 | 126.00 |
| | $52,741,919.59 | $10,011.75 |

### WHAT WE OWE (LIABILITIES)

| | |
|---|---|
| To pay for raw materials and wages | $ 2,600,653.64 |
| To pay taxes to Federal, State and Local Governments | 1,042,328.66 |
| To pay the dividend on our preferred stock, due June 1, 1938 | 112,500.00 |
| Reserve for wear and tear and depreciation on our equipment, including obsolescence | 10,368,861.78 |
| To cover the deposits of customers for drums, cylinders and carboys, when they are returned empty | 553,679.52 |
| For fluctuation in foreign exchange in case of foreign wars or other foreign contingencies | 234,298.05 |
| Reserve for other contingencies which may arise | 257,115.72 |
| Investment of our 8,963 Stockholders in our preferred and common stocks | 26,703,695.17 |
| Savings from past earnings, reinvested in the business | 10,868,786.76 |
| | $52,741,919.59 |

# Public Relations Begin at Home

*A welcome newcomer in chemical industry, the author presents some sound and interesting philosophy based on many years experience in the automotive and related fields of industry. His advice is most timely as chemical executives begin to give more serious thought to problems of public relations.*

**JAMES W. IRWIN**
*Assistant to the President*
*Monsanto Chemical Co.*
*St. Louis, Mo.*

EVEN THOSE WHO ARE IN THE PROFESSION of public relations do not know what public relations is. I have worked at it a long time and have heard some of the keenest brains in the business hem and haw in struggling with a definition. They can tell you what they *think* it is. But when it comes to getting down to good old-fashioned two-cent words, they can't put their fingers on it.

The best interpretation I have run across is that fired at me a few weeks ago by Edgar M. Queeny, president of Monsanto. He believed, first of all, that the term "public relations" is a misnomer and should not be used. He says, quite simply: "There is too much confusion and mystery about it. And how can something that is supposed to take the mystery out of business, succeed if it in itself implies mysterious activities? *Good public relations, in my opinion, is something that in an individual would be good morals and good manners.*"

Good morals and good manners! Doesn't that just about tell the story?

An individual who has good morals and good manners doesn't get into trouble, unless he is framed. A company, as a general rule, doesn't get into trouble if it has good morals and good manners, and again I cite the exception—unless it is framed. Unfortunately a lot of well behaved companies have been framed since 1932.

And good morals and good manners, in a company or in an individual, don't mean much more than the treatment of other companies or individuals, whether customers, shareholders, employees, neighbors, or general public, as they themselves would like to be treated if the positions were reversed.

Monsanto, for example, believes in detailed financial reports, quarterly and annually. It believes in telling the truth about unprofitable operations as well as about profitable ones, and there is no law that requires such frankness of a company made up of divisions. The company believes in telling its employees the truth: about operations, feeling that the employees should know everything the management would like to know if the situations were reversed.

Before the five-day week and vacations with pay for hourly rated workers were becoming the vogue, such policies were in effect in all our operations. No one would think of docking a salaried worker several days' pay for absence because of the death of a relative. We do not dock hourly workers for such absences in the belief that they are entitled to the same consideration in times of bereavement that is accorded straight-time employees.

Our policy on jury service, established in June, 1931, provides that employees shall not dodge such civil responsibility but must serve. This policy is in line with management thinking that the minds of regular employed persons are the most necessary in upholding justice and should be permitted to function in that capacity. Again, no one is docked for time spent on jury duty.

Our management doesn't believe in the double standard of service facilities for office and plant employees. Soap and towels and modern lockers are provided in plant washrooms just as they are in office washrooms.

Long before there was sharp-shooting at bonuses paid corporation executives, our chief executive, at his own request, was eliminated from the bonus group and put on straight salary so that he could make "yes" or "no" decisions on major problems without consideration of how such decisions might affect his bonus, one way or another.

These are just a few highlights to illustrate the type of thinking that a company must have in order to do the right sort of a job in the field of public relations.

The chief trouble has been that companies and individuals, while progressive and aggressive in most things, have been inarticulate and have not told their stories to an interested world, with the result that the bad habits of the few have attracted headlines and over-shadowed the good habits of the many.

When an industrialist goes to work on public relations and its ally, institutional advertising, he finds himself handicapped. While those who use every means to discredit him, hitting below the belt, making irresponsible and untrue charges, and calling names, may operate with immunity, he must, first of all, be a gentleman and ethical in every move.

He may not appeal to the dissatisfaction of those he wants to reach. But in his effort to develop a better knowledge of business and industry on the part of the public, doesn't he sometimes overlook the two greatest

Extracts from an address for the Industrial Marketers of Cleveland, Ohio, presented at the Cleveland Athletic Club, Nov. 4, 1938.

and most powerful of all groups—his own employees and his stockholders, each one of whom is a member of his family circle to whom he can talk frankly and convincingly? There are more employed persons than there are unemployed. There are more stockholders and more property owners than there are who own nothing. And those who are not employees of someone or stockholders in some private enterprise, are neighbors and close friends of those who are.

I cite these to show that every business man or industrialist has right at home, in his group of employees, in his group of stockholders, and in his operating community, thousands if not millions of persons who should know him, his company and their problems much better. Not that they might relieve him of any burdens, but because their future and progress are wrapped up in the success he and his fellow industrialists achieve. That is the bond of common interest.

But how to go about it? That always is the problem that stymies the man who can lick any engineering, production, financial or sales problem.

First, in a given plant or given community, or in a given company that operates in many communities, an intelligent study must be made to see if there is any dirty linen, any problems that are not favorable, which must be solved before any public relations activities are started.

There is no use trying to sell a company or an industry if someone can throw a muddy towel at the wrong moment and smear the program. It is much better to wash the towel and put it in the cabinet, then talk about the improvement. In other words, tom-tom beating when there are tommy guns and peeping Toms is not timely.

Industrial concerns will spend thousands and millions of dollars in product research to have something worthy of distribution to the buying public, something that will give service to the buyer and cause him to think of the manufacturer favorably, because he received value for his investment. They will spend more thousands in market research to determine where the best outlet will be, then back it up with other thousands in advertising, promotion and sales efforts.

But these same companies will fool around with employee and public relations, and not spend a dime on them until given trouble, or until trouble is in the offing. Isn't it just as important to know what is going on in the company or operating community at all times as it is to know what is going on inside the product and in the minds of prospective customers?

The soundest approach to any problem of public relations is simply research into the problem—what causes the problem and what means should be taken to reach a solution.

Have we analyzed our job sufficiently? Do we know thoroughly the problems of our individual firms and the field of American industry in which they are active? If we do, then we are ready to begin where we should begin—at home.

And the dividends of a job well done but *never completed* will be tremendous. Dividends in the form of personal satisfaction in helping to guide the thinking of fellow employees, neighbors and all others to understanding of the greatest good for the greatest number, and finding ourselves missionaries who have established the American business man and industrialist in the position where he belongs—that of contributor to employment, contributor to better living standards, contributor to sound government—a man who gives more than he gains, who is a good boss, a good associate and a good neighbor.

The research man, working in his laboratory, has a great deal to do with our future. The new process he invents today may mean work and wages for many people in the next few years. He is our job insurance. That's one reason why he is so important to all of us.

**"WHAT IS BEING DONE TO OFFSET 'DEPRESSIONS' AS THEY OCCUR?"**

Last year $1,011,629 was invested in research. Research not only makes jobs, it is also the best job insurance in this business . . . that is why it is so important to all of us. Research has been a major activity in Monsanto over a period of thirty-six years, and year by year it has shown its results in new products, better products, wider markets, more work and more pay.

As a result, our strength today rests on research as much as on the physical assets of the business, such as buildings, machinery and cash. Only through research, and

An excerpt from a page in Monsanto's much-talked-of 1937 Report to Employees, which forms an important part of the company's public relations program

Monsanto Employes work hand-in-hand. Plant Employes produce the new products and new processes that Research brings forth. Research makes possible the new jobs and new wages that result from those new products and processes.

# Low Temperature Refrigeration

*More and more, chemical engineers are working with processes requiring such low temperatures that an ordinary single-stage-compression refrigeration machine would be extremely inefficient. Professor Macintire explains here some of the fundamentals of multi-stage refrigeration as applied in low temperature work.*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IN LATE YEARS chemical engineers have found increasing need for refrigeration at temperatures as low as –50 to –100 deg. F. or even lower. Oil refining processes for wax removal have been using temperatures down to –50 deg. for 20 to 30 years but more recently a wider field has been created for temperatures as low, or lower, in the liquefaction of gases and the chilling of liquids, as in the manufacture of synthetic rubber.

It would be possible to use liquid air or solid carbon dioxide in attaining these temperatures, but a consideration of the cost and complexity of such a cooling system soon convinces one that other methods of securing low temperatures commercially are needed. This means the use of the usual type of compression refrigeration cycle, modified to permit economical low temperature production.

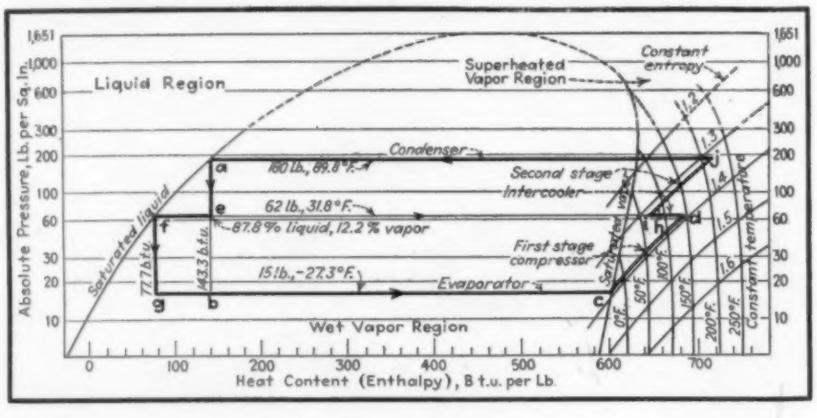
The best graphical method for the explanation of a refrigeration cycle is the total heat-pressure diagram, one of which is shown in skeleton form for ammonia in the accompanying figure. Superimposed on the chart is a two-stage refrigeration process operating between an evaporator temperature of –27.3 deg. F. (15 lb.) and a condenser temperature of 89.8 deg. F. (180 lb.).

It will be noted that the diagram is drawn for two compression stages, with compression from 15 to 62 lb. in the low pressure cylinder, followed by intercooling, injection of refrigerated vapor and final compression from 62 to 180 lb. in the high pressure cylinder. To follow the cycle let us start with ammonia liquid at 180 lb., as at *a*. The liquid passes through two expansion valves at *a* and *f* where it drops successively in pressure by throttling (constant enthalpy) from 180 to 62 lb. and from 62 to 15 lb. In passing through the first valve a part of the liquid is vaporized and the remaining liquid, which equals 1 — (143.3 — 77.7)/543.1 = 0.878 or 87.8 per cent, passes on to the second expansion valve. The vapor at 62 lb. and 31.8 deg. F. goes to the compressor where it assists in interstage cooling. The liquid, after further expansion to 15 lb., is completely vaporized in the evaporator at –27.3 deg. F. by heat absorbed from the process to be cooled and the vapor flows to the compressor. The useful refrigeration accomplished by each pound of ammonia in the cycle is numerically equal to $h_c - h_f$ times the weight of ammonia vaporized in the evaporator, or 0.878 (602.4 — 77.7) = 461.3 B.t.u. The work of compression in the low pressure cylinder is equal to the actual weight of ammonia compressed times $h_d - h_c$, or in this case, 0.878 (685.1 — 602.4) = 72.7 B.t.u.

The superheated discharge from the low pressure cylinder is indicated as being cooled at constant pressure in a water-cooled intercooler from point *d* to *h*, which is about 85 deg. F. This vapor then mixes with that from the first stage expansion valve (31.8 deg. F.) and the mixture at about 78 deg. F. (point *i*) is compressed from 62 to 180 lb., requiring work of $h_j - h_i$ for each pound of ammonia in the cycle, or 721.5 — 649.3 = 72.2 B.t.u.[1]

It is convenient to be able to calculate, at least theoretically, the degree of perfection of the refrigeration cycle by calculating the ratio of useful refrigeration obtained to the work of compression that is required. This factor is called the coefficient of performance. For the conditions in the figure this coefficient is 461.3/(72.7 + 72.2) = 3.183. The larger this value the less the amount of work

**Temperature-enthalpy chart for ammonia showing cycle for 2-stage refrigeration process operating between temperatures of 89.8 deg. F. and –27.3 deg. F.**



that has to be performed by the compressor in accomplishing a given amount of useful refrigeration. It is clear from the diagram that the work of compression increases as the temperature difference between the evaporator and the condenser increases. Since the condenser temperature is necessarily somewhat higher than that of the available cooling water (usually 70-90 deg.), low temperature refrigeration requires a large temperature difference, which means that compression work will be considerable and the coefficient of performance small.

More or less complete tables of properties of all the important refrigerants are included in handbooks, but a common method of comparing refrigerants is to do so at two standard temperatures (5 deg. F. evaporation and 86 deg. F. liquefaction) as in Table I. The table gives not only data on the critical temperature and pressure and the ratio of specific heats, but also the heat content for the various refrigerants at the several points in a single-stage compression cycle; the coefficient of performance which compares with the value of 5.74 for the ideal Carnot cycle; the specific volume of the refrigerant at the evaporator pressure; the piston displacement and rate of refrigerant flow required to produce refrigeration at standard rate; the evaporator and condenser pressures; and information regarding explosion and health hazards. Although theoretically the coefficient of performance is independent of the working medium, actual refrigerants deviate from the ideal and cannot reach the coefficient of the Carnot cycle.[2]

Both reciprocating and centrifugal compressors are used for refrigeration, the type depending upon the physical properties of the refrigerant. The first type, which is very much like the air compressor in construction, is limited to the inclosed-crankcase, vertical, single-acting type and is usually provided with forced feed lubrication. Two, three or four cylinders operate on the same crank shaft, and in duplex types, two four-cylinder machines are connected with the same motor. The displacement, of course, is fixed, and the number of revolutions per minute limited by design considerations. Hence the capacity varies with the temperature of evaporation owing to the increase in specific volume of the vapor with decrease in evaporation pressure.[3]

The centrifugal compressor, which is similar in principle to the centrifugal pump with diffuser blades, involves losses which make the power consumption higher than that of a well designed reciprocating machine. Nevertheless the centrifugal machine has certain advantages which may dictate its use. It operates at high speed and so is suitable for direct connection to steam turbines and high speed electric motors. It is easily balanced, requires no internal lubrication, has no valves and does not wear due to metal-to-metal contact.

At present the refrigerants that have been used for low temperature work at –100 deg. F. have been limited to ammonia and ethane. Carbon dioxide, with a triple point at –69.9 deg. F., is not used except in special cases where dry ice is suitable. A comparison of refrigerants at –100 deg. F. appears in Table II. The indicated coefficients of performance are higher than actual since no allowance was made in the calculations for losses due to friction and to the superheating of the suction vapor. For this reason the indicated piston displacements are too low.

### Footnotes

1. It is quite possible to dispense with water intercooling entirely, using liquid refrigerant cooling, at 31.5 deg. F. in this case the D. I. Davis method), to remove all the superheat from the vapor entering the high pressure cylinder. In fact, there is some theoretical advantage in doing so.
2. Nevertheless it will be noted that the coefficients are reasonably uniform, which is true for most vapors of which the physical properties are known. In spite of the similarity of coefficients of performance, however, note that the required piston displacements vary widely.
3. Saturated ammonia, for example, has a volume of 4.83 cu. ft. per lb. at 30 deg. F. (59.74 lb. per sq. in. abs.), 9.12 cu. ft. at 0 deg. (30.42 lb. abs.), 33.1 cu. ft. at –50 deg. (7.67 lb. abs.) and 182.9 cu. ft. at –100 deg. (1.24 lb. abs.). Since the ability of the refrigerant to absorb heat during its boiling in the evaporator is almost directly proportional to the weight of refrigerant evaporated, it is clear that the capacity of the refrigerating machine must drop off rapidly with decreasing evaporator temperature.

**Table II—Refrigerants for low temperature work compared at –100 degrees F.**

| Refrigerant | No. of stages | Compression Ratio | | | Vol. of vapor at –100° F. ft.³/min./ton | Coeff. of performance for system |
|---|---|---|---|---|---|---|
| | | Stage 1 | Stage 2 | Stage 3 | | |
| Ammonia[1] | 3 | 8.4 | 4.6 | 3.2 | 62.4 | 1.67 |
| Ammonia[1] | 3 | 5.0 | 5.0 | 5.0 | 62.2 | 1.59 |
| Ammonia[2] | 3 | 5.0 | 5.0 | 5.0 | 62.1 | 1.59 |
| Ammonia and ethane[3] | 2 | 6.5 | 6.5 | ..... | 58.1 | 1.36 |
| Freon 12[4] | 2 | 14.1 | 4.9 | ..... | 80.5 | 1.23 |

[1] Davis system.
[2] No refrigerant cooling of vapor between stages.
[3] Ammonia used to condense ethane.
[4] Approximately the cycle used in centrifugal compression.

**Table I—Comparison of refrigerants at 5 deg. F. evaporation and 86 deg. liquefaction (no subcooling nor superheat)**

| Refrigerant | Critical temperature (deg. F.) | Press. corr. to crit. temp., (lb. per sq. in.) | $\frac{C_p}{C_v} = K$ | Heat content of sat. vapor, at 5 deg. F, $h_g$ | Heat content of liquid at 86 deg. F, $h_a$ | Useful refrigeration, $h_g - h_a$, (Btu. per lb.) | Theo. work of compression, $h_g + h_a$ (Btu. per lb.) | Specific vol. at 5° F. (Cu. ft. per lb.) | Coefficient of performance | Piston displacement per ton per min., (cu. ft.) | Weight of refrigerant per ton per min., (lb.) | Evaporation pressure (Lb. per sq. in.) | Liquefaction pressure (Lb. per sq. in.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ammonia | 271.4 | 1651.0 | 1.288 | 613.3 | 138.9 | 474.4 | 99.6 | 8.15 | 4.77 | 3.44 | 0.422 | 34.27 | 169.2 |
| Sulphur Dioxide | 314.8 | 1141.5 | 1.256 | 183.49 | 42.12 | 141.37 | 29.2 | 6.42 | 4.69 | 9.08 | 1.415 | 11.81 | 66.45 |
| Carbon Dioxide | 88.0 | 1069.9 | 1.30 | 138.8 | 83.3 | 55.5 | 25.9 | 0.266 | 2.41 | 0.958 | 3.60 | 332.0 | 1043.0 |
| Dichlorodifluoromethane (Freon 12) | 233.0 | 582.0 | 1.15 | 78.70 | 27.72 | 51.07 | 10.85 | 1.485 | 4.71 | 5.81 | 3.92 | 26.51 | 107.9 |
| Ethyl Chloride | 369.0 | 764.0 | 1.13 | 163.55 | 21.0 | 142.55 | 26.8 | 16.10 | 5.32 | 23.59 | 1.404 | 4.50 | 27.15 |
| Methyl Chloride | 289.6 | 969.2 | 1.199 | 194.2 | 43.9 | 150.3 | 32.0 | 4.65 | 4.70 | 6.20 | 1.332 | 21.0 | 95.5 |
| Butane | 308.0 | 529.0 | 1.11 | 172.2 | 48.5 | 123.7 | 26.7 | 9.98 | 4.63 | 16.14 | 1.619 | 8.2 | 41.6 |
| Propane | 204.1 | 661.5 | 1.15 | 172.0 | 51.0 | 121.0 | 27.5 | 2.48 | 4.40 | 4.10 | 1.654 | 42.1 | 155.3 |
| Dichloroethylene (Dieline) | 470.0 | 795.0 | 1.14 | 137.5 | 23.22 | 114.3 | 25.06 | 64.35 | 4.57 | 112.6 | 1.752 | 0.874 | 14.65 |
| Methylene Chloride (Carrene) | 421.0 | 670.0 | 1.185 | 163.8 | 29.24 | 134.6 | 28.6 | 51.3 | 4.71 | 76.23 | 1.485 | 1.17 | 20.48 |
| Water Vapor | 706.0 | 3200.0 | 1.32 | 1061.3 | 54.0 | 1007.3 | 242.0 | 11520.0 | 4.17 | 2288.0 | 0.1986 | 0.0240 | 0.6153 |

*Explosive ranges, % by vol. in air:* Ammonia, 13.1 to 26.8; ethyl chloride, 4.3 to 14.0; methyl chloride, 8.9 to 15.5; butane, 1.7 to 5.7; propane, 2.4 to 8.4.

*Toxicity (in % by vol.) which will kill most animals in a short time:* Ammonia, 0.5 to 0.6 in 30 min.; sulphur dioxide, 0.7 in 5 min.; carbon dioxide, 29 to 30 in 30 to 60 min. (10% cannot be tolerated over 5 min.); ethyl chloride, 6.0 to 10.0; methyl chloride, 2.0 to 2.5 in 2 hr.; butane, 2.4; propane, 2.4; dichloroethylene, 2.0 to 2.5 in 2 hr.; methylene chloride, 5.1 to 5.3 in 30 min.

*Remarks:* Ammonia and sulphur dioxide are easily detected. 20 per cent dichlorodifluoromethane is not permanently harmful after exposures of from 7 to 8 hours. Ethyl chloride, butane and propane are fire hazards. Ammonia and methyl chloride are slight fire hazards.

# Design of Metal Bins

*First of a series of three articles by Mr. Sandstrom on bins in the chemical industries, this discussion considers design factors where the construction material is a metal. The later articles will be concerned with bins of wood and concrete.*

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THE PRIMARY consideration in the design of a bin is, of course, its ability to perform properly the functions of feeding or storing materials. But frequently, there are cases in which this and other factors must be largely subordinated to cost, as in the so-called "haywire" plants where brains must do much of the work of capital. Not surprisingly, some of the unorthodox creations originated under such conditions are exceedingly ingenious, and so in this article several are described along with the more conventional types of bin designs.

### Foundation and Walls

The simplest bin, or tank, is of steel, cylindrical in form, and rests on the ground. In order to prevent the foundation soil washing out and tilting the tank, with consequent damage to connecting piping, foundations are sometimes made of compacted crushed stone, or of concrete in the form of a wall. More elaborate foundations may be conceived but scarcely more economical.

Tanks at ground level must have pumps to recover the stored liquid. Bins containing non-liquids are served by pits or tunnels which house conveyors and elevators.

The first step in the design of a bin or tank is to determine the unit pressure exerted on its walls by the contents. In the case of a liquid this is simply the unit weight times the height, or head. Non-liquids, however, exert far less lateral pressure than liquids; the pressure depends on the density of the filling and, to a greater extent, on its form, surface smoothness and size of particles.

The form of the particle and the condition of its surface have even greater influence than the fineness. All three, however, determine the angle of repose, which is the angle that the surface of the body of the material assumes with the horizontal, and which is a measure of its lateral pressure on the bin walls. For instance, it would be impossible to make a heap, on a smooth floor, of steel ball bearings. Here we have a material whose particles are large and of extreme density but of such form and smoothness that they run helter-skelter over the floor and quite obliterate any angle of repose. On the other hand a freshly ground Portland cement, the particles of which are neither spherical nor smooth, will flow almost like water. An attendant in a cement-plant, stopping up a leak in the discharge spout of a finish-grind tube-mill was heard to say, "The damned stuff seems to be alive!"

The flowability of such materials as freshly ground cement and pulverized coal is caused by the particles being enveloped in a film of air, which gives fluid properties to the material. It might be said that the material is lubricated by the air. After standing for a time in a bin there is settling caused by the removal of some of the air and the locking together, or "articulation," of the particles, and the material will stand up almost in a vertical bank.

The pressure on bin walls, and the resulting friction, carries a portion of the vertical load to the walls, relieving the bottom of this load. Tests with granular materials indicate that when the depth of the bin exceeds three times the diameter there is so slight an increase in the bottom and lower wall pressures that it may be disregarded in the design of the bin. Prof. Milo S. Ketchum in his book, "The Design of Walls, Bins and Grain Elevators," (McGraw-Hill) describes tests which indicate that in the case of deep bins the bottom should be designed for the weight of the contents 2.5 diameters deep uniformly distributed. The walls at the bottom should be designed for the lateral pressure imposed by the contents three diameters deep, and in addition the vertical load of the superimposed contents carried to the wall by friction, plus the weight of the wall itself.

Excepting grain and cement bins few have heights exceeding two diameters, so the majority of designs need not consider the proportion of the load transmitted to the walls with its corresponding relief to the bottom. Of course, a portion of the load is carried to the wall by friction whatever the depth, but in shallow bins it does not seem worth considering in view of inadequate knowledge of the actual strength of structural materials.

### Determination of Lateral Pressures

Numerous tests have been made to determine the lateral pressures exerted by various materials. Small size models of bins were generally used which probably did produce reliable data for some coarse materials. But in the case of finely ground materials such as Portland cement and pulverized coal, the conditions of the full size bin were not exactly simulated—the time element not being adequately represented. During the time required to fill a full size bin some of the air is squeezed out of the material, thus reducing its fluidity and consequently its pressure on the walls. Tests with cement in model bins produced lateral pressures on the order of 40 per cent of the vertical pressure, or the pressure equivalent of a liquid weighing about 40 lb. per cu.ft. A number of

successful bins, still in use, had their wall designs based on the behavior of a liquid weighing 20 to 25 lb. per cu.ft.

In the last column of the following table are weights of liquids that would exert the same lateral pressure as the materials in the first column. They were derived from the formula $L = \frac{w(1 - \sin\theta)}{1 + \sin\theta}$, in which w = weight of material in lb. per cu.ft., and $\theta$ its angle of repose.

| Substance | Weight Lb. per cu.ft. | Size — Mesh | Liquid Equiv. Lb. per cu.ft. |
|---|---|---|---|
| Ashes | 40 | 2 in. | 9 |
| Barley | 39 | ..... | 15 |
| Cement (portland) | 100 | 96%–100 | 25 |
| Clinker (cement) | 90 | –1½ in. | 25 |
| Coal (bituminous) | 50 | –1½ in. | 13 |
| Coal (anthracite) | 52 | –1½ in. | 20 |
| Coal (pulverized) | 44 | 98%–100 | 15 |
| Coke | 30 | –3 in. | 7 |
| Corn | 45 | ..... | 17 |
| Earth (dry) | 100 | ..... | 22 |
| Earth (mud) | 110 | ..... | 60 |
| Gravel | 110 | –1½ in. | 30 |
| Limestone | 100 | –2 in. | 22 |
| Rock salt | 48 | –½ in. | 16 |
| Sand (dry) | 95 | –¼ in. | 27 |
| Sand (moist) | 90 | ..... | 20 |
| Wheat | 50 | ..... | 18 |

A deep bin designed for the pressures in the table would, however, be much stronger than need be. The mutual influence of the sides is such as to reduce considerably the pressure on them. And as the ratio of depth to diameter increases, more of the load is transferred to the walls by friction and carried down as direct compression.

There is no short cut to the economical design of a bin because of the several variables such as density of contents; angle of repose of contents; friction of contents on the walls which varies with the surface condition; and ratio of depth of bin to diameter, the pressure increasing directly with the diameter for constant depth-diameter ratio. To illustrate the effect of the factors enumerated we shall take for example a wheat bin 20 ft. in diameter by 60 ft. deep, made of steel plate. If designed for a liquid of 18 lb. per cu.ft., the lateral pressure to be withstood by the lowest part of the wall would be 1,080 lb. per sq.ft. According to the Janssen formula the actual pressure is about 634 lb. per sq.ft., thus permitting a worthwhile saving. So for economical design of a bin, one must consult a treatise such as Prof. Ketchum's.

### Overhead Bins

Overhead bins at once serve the purpose of storage and feeders, a common example being coal bins serving steam boilers. In Fig. 1 and Fig. 3 are a few types of bins that were proposed for a certain plant containing ten boilers in five batteries. Type 1 (a) was proposed merely as an example of what could be done. The superintendent of power, a man who was little hampered by tradition, approved the design and the bins were installed. When last I saw them, they had been in service 15 years, and were practically as good as new.

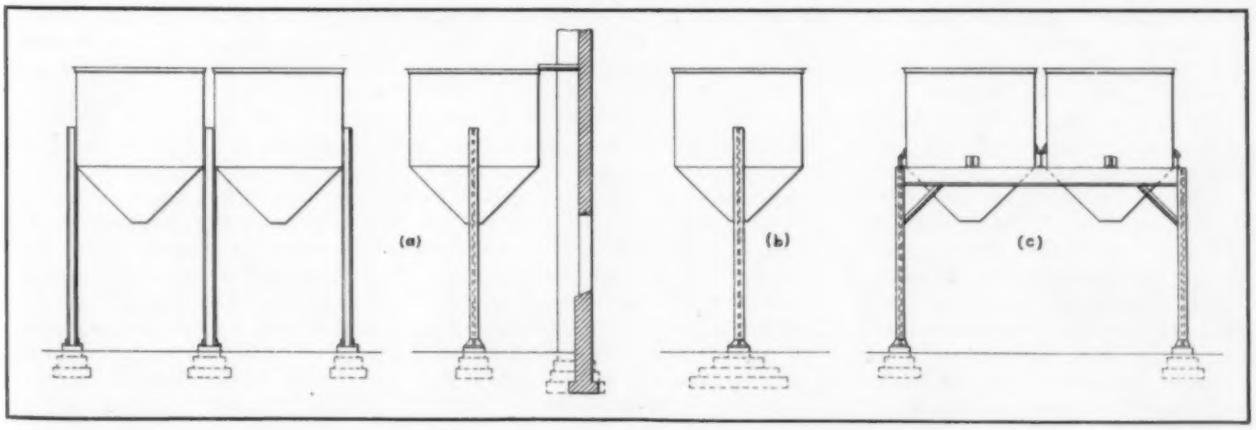
The bins of 1(a) are tied to the building wall at their tops with angles to hold them erect, but they can be made entirely self-supporting by extending the foundations as shown at (b). The overturning forces are those due to unsymmetrical loading and, in the case of an outside installation, wind pressure. This type of bin, though departing from the conventional, is practical and cheap. The bins of (c) can be made either circular or rectangular. The bag-bottom, or suspension bin of Fig. 3 probably is the cheapest overhead bin for large capacity. There are certain assumptions in its design, however, that do not appear logical, but which will be discussed later.

In Fig. 2(a) is shown a bin serving a vacuum ash-handling system in the plant containing the coal bins of Fig. 1(a). Because of railroad tracks in the yard to the left, it was impossible to use the ordinary column arrangement. Suspended beneath the gallery were pipes carrying steam, water, gas, ammonia and brine, which could not be moved except at great expense. It was found that a chord of a truss could be passed between the pipes without disturbing any of them, and the cantilever shown was the result.

In Fig. 2(b) is shown the construction of a pair of bins for pulverized coal, serving rotary kilns. This job was in a plant rebuilt with little money and can be placed in the "haywire" category. The bins were made from cyclone separators 10 ft. in diameter, and with shells less than one-eighth inch thick. The shells were stiffened with steel angles after the fashion of plate girders, and the columns were riveted to the shells for added stiffness. These bins were entirely satisfactory.

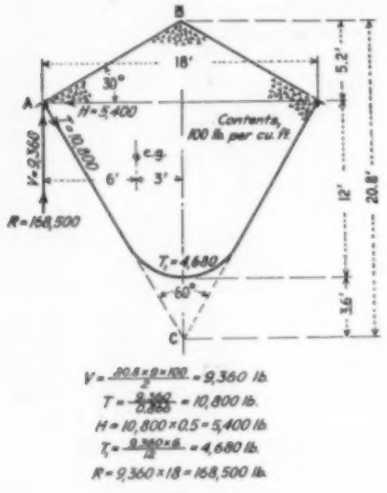
Circular, and bag-bottom bins, if designed to resist corrosion and the forces encountered during erection, will generally have plate sufficiently thick to carry the internal pressure. For example the plate thickness required for a riveted bin 20 ft. in diameter and 30 ft. deep, filled with

Fig. 1—Types of overhead coal bins proposed for a certain boiler plant installation. Bins of type (a) were installed and have given satisfactory service for fifteen years. They can be made entirely self-supporting by broadening the foundation as shown at (b).



a material that exerts a lateral pressure equivalent to a liquid weighing 25 lb. per cu.ft., is calculated to be 0.065 in.—a trifle more than $\frac{1}{16}$ in. It is doubtful if anyone would seriously propose a bin 20 ft. in diameter and 30 ft. deep made of $\frac{1}{16}$-in. steel. When empty, such a bin would not sustain the wind pressure that buildings are required to bear, unless stiffened at the top with an angle or by a roof. Practical considerations alone would demand a minimum plate thickness of $\frac{3}{16}$ in.

In Fig. 3 is a cross-section of a suspension bin. In the common method of design it is assumed that the stress in the sides is purely tensile along the periphery of the cross-section as indicated by the letter *T* in the figure. When the bin is supported at its edges by beams, the ordinary assumption is correct, but sometimes the edges are merely stiffened by angles as in the figure, that have slight effect as beams. We must conclude then that the bin is itself a beam in the longitudinal direction and that the angles function as flanges.




$V = \frac{20.8 \times 9 \times 100}{2} = 9{,}360$ lb.

$T = \frac{9{,}360}{0.866} = 10{,}800$ lb.

$H = 10{,}800 \times 0.5 = 5{,}400$ lb.

$T = \frac{9{,}360 \times 6}{12} = 4{,}680$ lb.

$R = 9{,}360 \times 18 = 168{,}500$ lb.

**Fig. 3**

Let us assume the correctness of the conventional method of design. The stored material, weighing 100 lb. per cu. ft., is heaped to an agle of 30 degrees. Neglecting the filling in the area between the dotted lines prolonging the sides of the bin, the weight of the filling in one-half of the bin, or *A*, *B*, *C*, for a length of one foot is $20.78 \times 9 \times 100/2 = 9{,}360$ lb., represented in the figure by *V*. The horizontal component *H* is *V* tan $30° = 9{,}360 \times 0.577 = 5{,}400$ lb., and the resultant *T*, or the maximum stress in the plate per foot of length is $V/\cos 30° = 9{,}360/0.866 = 10{,}800$ lb. Assuming a riveted joint of 60 per cent efficiency and a tensile stress of 16,000 lb. per sq. in. in the net section, the thickness of plate is $10{,}800/12 \times 0.60 \times 16{,}000 = 0.09375$ in., or 13-gage.

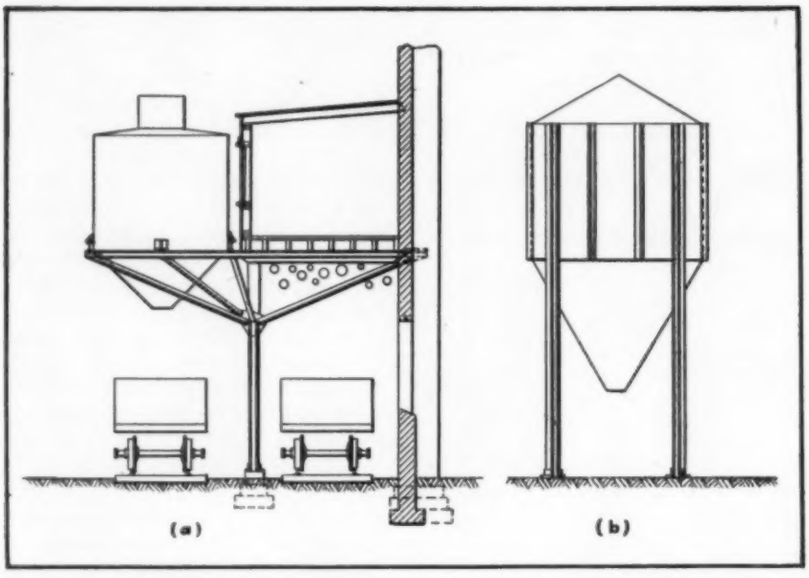



**Fig. 2—(a) Obstructions made it necessary to use a cantilever support for this hopper. (b) A bin made by reinforcing a discarded 10-ft. dia. cyclone separator**

The stress *T* is found by removing the right-hand half of the figure and taking moments about the point *A*. The center of gravity of the load in the left-hand half *A*, *B*, *C* of the bin is 6 ft. from a vertical passing through *A*, and the load moment is $9{,}360 \times 6 = 56{,}160$ ft. lb. per foot of length of bin. Dividing by the resisting moment arm of 12 ft., we have $56{,}160/12 = 4{,}680$ lb. per ft., and the required thickness is $4{,}680/12 \times 0.60 \times 16{,}000 = 0.0407$ in.

Of course, the thickness of metal just found is not practical—in many cases the allowance for corrosive exceeds it. Furthermore, if the bin is supported along its length by beams that transmit the load to the supports, the thin plate would be satisfactory so far as the load is concerned; but if, as in usual practice, the bin is riveted directly to the support, there is a large concentration of load in a small area of the plate, and thickness of plate found in the foregoing would be entirely inadequate.

In the kind of work under discussion, in which the stresses are so low that other factors determine the thickness of plate, the designer must decide whether to use an excess of cheap plate or of comparatively costly rivets at the supports. In the case of a suspension bin, thick plate with the proper size of rivets may be used at the supports, and thinner plate between, thus effecting a saving.

With a shearing stress of 10,000 lb. per sq. in., a $\frac{3}{4}$-in. rivet driven into a $\frac{13}{16}$-in. hole will transmit 5,185 lb. With a bearing stress of 20,000 lb. per sq. in., the plate thickness is $5{,}185/20{,}000 \times 0.8125 = 0.319$ in., say $\frac{5}{16}$ in.

An example of the effect of tradition is seen in riveting practice. In the design of structures it is the custom to use nominal size rivets; that is, no advantage is taken of the fact that the rivet fills the hole and so has an increased diameter. But in steam boiler practice the rivet is assumed to fill the hole. The former practice is excused on the ground that the error is on the side of safety. It would seem, however, that the additional safety could better be obtained by reducing the working stress than by perpetuating an obvious fiction. Of course, the actual diameter of the hole is used in designing the member.

Though the triangle of forces does not correctly represent the condition in a section of the length of the bin between supports, it does indicate the condition at the supports. A bin that is truly continuous over intermediate supports should be designed for the increased vertical reactions consequent on continuity. So for a bin of two spans the intermediate support will carry 25 per cent more of the

vertical load than it would if the inside ends of the two spans merely rested on the support. And for additional spans the increase runs upward of 13 per cent. Since 25 per cent increase is the maximum for any number of spans, we shall use this value. The reaction at the intermediate support for two 18 ft. spans of the bin under discussion is then $18 \times 1.25 \times 9{,}360 = 211{,}000$ lb., the force $T$ in the plate is $211{,}000/0.866 = 243{,}000$ lb., and its horizontal component $H$ is $243{,}000 \times 0.5 = 121{,}500$ lb. By

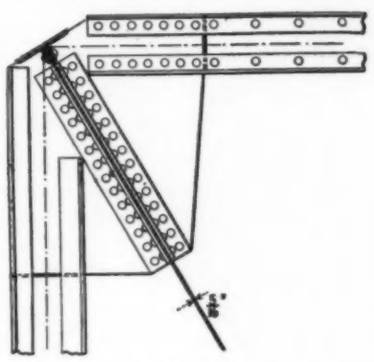


Fig. 4

conventional rivet practice the required number of ¾-in. rivets in single shear is $243{,}000/0.4418 \times 10{,}000 = 55$, or 28 rivets in double shear. In Fig. 4 is a detail of the connection.

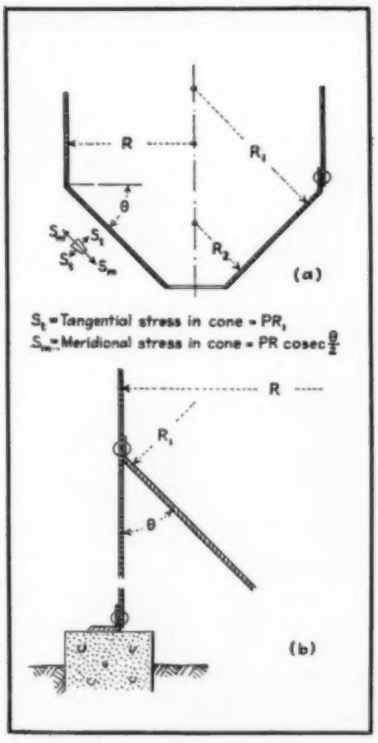
If the bin functions as a beam whose span is the length between supports, it makes little difference whether it is designed from consideration of the modulus of the cross-section or as a plate girder whose flanges only are assumed to resist bending moment. Either method provides ample resistance. For example assume that one half section of the bin carries one half the load as a simple beam. The bending moment is then $9{,}360 \times 18^2 \times 12/8 = 4{,}550{,}000$ in. lb.; and with a stress of 16,000 lb. per sq. in., the required section modulus is $4{,}550{,}000/16{,}000 = 284$ in.$^3$ Disregarding the form of the bin and assuming one side of it to be merely a plate 12 ft. deep, and assuming a joint efficiency of 60 per cent, the required thickness of the plate is $284 \times 6/144^2 \times 0.60 = 0.137$ in. Since practical considerations demand a thickness of upward of $\frac{1}{4}$ in., our "beam" is satisfactory except that the upper edge must be stiffened against buckling.

Designed as a plate girder, and neglecting the influence of the plate on bending moment, the area of the flange is $4{,}550{,}000/144 \times 16{,}000 = 1.98$ sq. in., corresponding to a pair of $2\frac{1}{2} \times 2 \times \frac{1}{4}$-in. angles. The flange being in compression, however, has a tendency to buckle sideways, though not strictly in the manner of a column that is loaded at the ends, since the flange carries a compression load varying from a maximum at mid-span to zero above the supports for a single span, and zero at about the quarter points for continuous spans. If the width of the flange is made 1/30 of the length of bin between supports, it will be satisfactory. In the present case the flange is $18 \times 12/30 = 7.2$ in., say a pair of $3\frac{1}{2}$-in. angles.

Though circular bins are cheaper than rectangular ones, the latter are sometimes used to obtain maximum capacity in a limited space. But flat plate must be stiffened to resist transverse loading, and stiffeners are comparatively expensive; so when rectangular bins are contemplated it should be borne in mind that though a square bin has 27 per cent greater capacity than a circular one of the same diameter, its cost is about 50 per cent greater.

The bottoms, or hoppers, of circular bins may be conical or spherical. In the conical type the maximum stress, both tangential and meridional, is at its junction with the shell. The tangential stress is determined by multiplying the unit pressure by the normal radius $R_1$. The meridional stress $S_m$ equals the longitudinal stress in the shell multiplied by the cosecant of the angle of the cone with the radius of the shell, or $PR$ cosec $\Theta/2$. The stress at any other point on the cone is found similarly, using the normal radius at that point.

Fig. 5—(a) Joints in a conical hopper. (b) Detail of skirt type support




### Design of Conical Hopper

To illustrate the method of design we shall use for example a bin 10 ft. in diameter with a conical hopper whose angle $\Theta$ is 45 degrees. The contents of the bin weigh 100,000 lb., and the pressure at the junction of the cone and shell is $100{,}000 \times 4/120^2 \pi = 8.85$ lb. per sq. in. The radius $R_1$ is $60 \times 1.414 = 84.84$ in. The tangential stress is then $8.85 \times 8.84 = 750$ lb. per lin. in. and the meridional stress $8.85 \times 60 \times 1.414/2 = 375$ lb. per lin. in., or one-half the tangential stress. With a joint efficiency of 60 per cent, and an allowable stress of 16,000 lb. per sq. in., the required thickness of plate is $750/16{,}000 \times 0.60 = 0.078$ in., or $\frac{5}{64}$ in. Metal as thin as $\frac{5}{64}$ in., though capable of withstanding the static forces, does not provide sufficient resistance to impact of the filling, nor does it allow for wear or corrosion. A practical bin of this diameter would have a hopper of not less than ¼ in. plate. Fig. 5 (a) shows a conical hopper with two kinds of joints, butt and lap, the former welded and the latter riveted.

In Fig. 5 (b) is a hopper bin with the wall, or skirt, carried down to the foundation. Doorways, or other openings may be cut in the skirt. The stresses in the hopper are as found in the foregoing, but the skirt carries the total load in compression.

The stress in a hemi-spherical hopper is $PR/2$ which, in the last case would be $8.85 \times 60/2 = 265.5$ lb. per lin. in. With a joint efficiency of 60 per cent, the plate thickness is $265.5/16{,}000 \times 0.60 = 0.0277$ in., or less than $\frac{1}{32}$ in.—also not a practical thickness for the reasons given.

By the foregoing we see that the static stresses in small bins have little to do with the choice of thickness of plate—impact, corrosion or connections, singly or combined, are the determining factors.

# Surface Area in Packed Columns

***A new experimental approach to the determination of surface area forms the basis for this correlation of factors involved in pressure drop through packed columns. Data show that surface area of irregular substances is always much less than that of spheres of the same average diameter.***

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IN THE STUDY OF SURFACE PHENOMENA (crystal growth, particle solubility, absorption, etc.), it is important to know the actual free surface of an aggregate of irregular particles. Similarly, the power required for rock and ore crushing is dependent upon the amount of new surface produced. In determining the free surface of irregular particles, it has long been recognized that surface based upon the equivalence to spheres of the same average diameter leads to erroneous results. This paper is designed to show a new experimental approach to the solution of this important problem by means of the relations known to exist between the pressure drop in a packed column (when air within the viscous low range is made to pass through it) and the total surface of the particles constituting the packing.

### Theoretical Considerations

A correlation of the factors determining the pressure loss through packed columns is a matter of considerable difficulty. The relations existing between the pressure drop, the size and shape distributions of the material constituting the packing, and the geometrical arrangement of the packing itself, are factors which are not easily susceptible to mathematical analysis. Only in simple cases where these factors are determinable can comprehensive expressions of their relationship be derived. A generalization of all conditions with regard to the materials used is impossible. Granular material cannot be compared with disk-like material which lumps itself face to face, or with cylindrically-shaped material which packs loosely.

Recent investigators of the energy losses sustained by a fluid flowing through a packing may be classified into two groups. The first, led by Zeisberg[1] and Furnas[2], has correlated its experimental and practical data in an empirical manner. The latter, particularly, has investigated the problem of flow through a blast furnace and has given the most complete data on that subject which are at present available. Nevertheless, the applications of his results are very involved and require some skill in their manipulation. The second group, on the other hand, led by Blake[3] has applied the methods of dimensional homogeneity to the problem. It has supplied a forceful method of attack and it is indeed regrettable that Furnas did not consider it in his published investigations. Burke and Plummer[4] have followed Blake in an excellent treatment of the problem of gas flow through a column made of *spherical* shot. While undoubtedly there are certain assumptions made by these investigators which are open to question, their results are simple and easy to interpret, and will therefore be used as a basis for the analysis of data here presented.

**Table of Nomenclature**

(*Use consistent units throughout*)

| | |
|---|---|
| $\Delta P$ | = pressure drop through packing |
| $L$ | = length of packing |
| $S$ | = surface of unit quantity of packing |
| $\rho$ | = fluid density |
| $\mu$ | = fluid viscosity |
| $f$ | = fractional free space |
| $u$ | = linear fluid velocity based on empty tower |
| $n$ | = exponent (varies with type of flow) |
| $d$ | = diameter of particles of packing |
| $\phi$ | = modified friction factor of Chilton and Colburn [5] |
| $\alpha$ | = surface shape factor |
| $N$ | = number of particles per unit of packing |
| $\sigma$ | = geometric standard deviation |
| $k,C$ | = constants |

### Burke and Plummer Equation

From considerations of the methods of dimensional analysis, Burke and Plummer derive the following equation for the pressure drop through a packing

$$\frac{\Delta P}{L} = k \frac{\rho u^2 S}{f^3} \left( \frac{\mu S f}{\rho u (1 - f)} \right)^{2-n} \quad (1)$$

where $\rho$ and $\mu$ are the density and viscosity (in centipoises), respectively, of the fluid, $u$ is the average velocity in centimeters per second through the tube with the packing removed, $S$ is the surface of a unit quantity of the packing in square centimeters per cubic centimeter, and $f$ is the fractional free space. The term $\Delta P/L$, of course, is the energy loss, usually expressed in centimeters of water per centimeter length of the packing. The exponent $n$ depends upon the nature of the flow. It varies from a value of one for streamline flow to a value of 2 for turbulent flow. For the former condition, we get

$$\frac{\Delta P}{L} = k \frac{S^2 u \mu}{f^3 (1 - f)} \quad (2)$$

Two considerations are implied in the original derivation of Equation (1) which we shall discuss here. It

is self-evident, first, that the velocity through the packing is approximately of the order $u/F$ where $F$ is defined as the mean free cross-sectional area of the packed column. The value of $F$, however, can be determined for particulate substances only with considerable difficulty, whereas the value of fractional voids $f$ is easily obtained. Moreover, since the possibilities of making a strictly uniform packing are slight, the term $u/f$, as used by Burke and Plummer[4] must be regarded as an adequate although approximate measure of the average velocity through a packing. Chilton and Colburn[5] in an interesting paper which we shall discuss later have considered the flow of a gas as taking place through a series of small orifices and employ a correction for a portion of the energy losses in terms of the expansion and contraction of the fluid in passing through them. The formula developed, unfortunately, contained factors which were indeterminable. We shall, therefore, in the present paper restrict ourselves to the use of the term $u/f$ to express the average velocity of a gas through a packing. By its use, the resultant expressions are simplified, yet express the data adequately.

The second consideration involved in Equation (1) is the nature of the packing itself. Obviously, if the packing is loose, the resistance is small, and if very dense ($f = 0$), the resistance may become infinite. To meet these two possible extremes, the function $f/(1-f)$ has been introduced. It is a curious fact that in Equation (1), Burke and Plummer[4] have considered this function to be unity in their final analysis, a rather broad assumption although their data appear to warrant it.

Data of Burke and Plummer are shown plotted in Fig. 1, according to their final relation

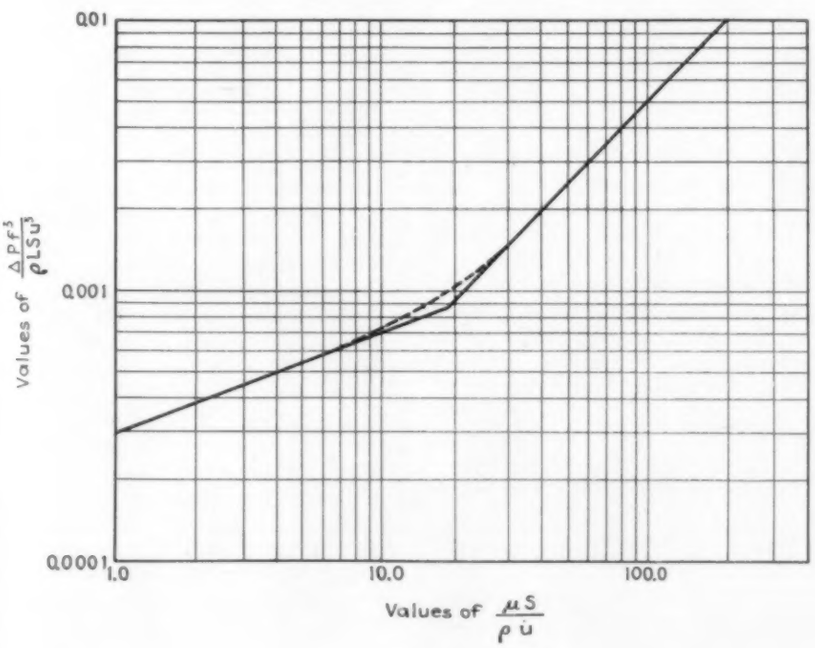
$$\frac{\Delta P}{L} = k\,\frac{\rho\, u^2\, S}{f^3}\left(\frac{\mu\, S}{\rho\, u}\right)^{2-n} \qquad (1')$$

It will be noted that the dotted portion is intended to make the curve continuous from turbulent through viscous flow. There are no data to warrant such a liberty, except that in most experimental work done so far, the data are scattered in a rather wide array near the critical point. Restricting ourselves to the value of $n = 1$, we get by the aid of Equation (1′)

$$\frac{\Delta P}{L} = 0.00005\,\frac{\mu\, S^2\, u}{f^3} \qquad (3)$$

which is the equation of the straight line in Fig. 1 to the left of the critical point.

Fig. 1—Relationship between factors which determine the pressure drop in packed columns as given in Equation (1′) above. Data from Burke and Plummer[4]. However, data of Chilton and Colburn produce the same curve




Chilton and Colburn[5] have shown that the work of all the investigators thus far, as well as their own, may be made to fit the relation

$$\phi = C\left(\frac{\mu}{d\ \rho\ u}\right)^{2-n} \qquad (4)$$

where $\phi$ is the modified friction factor (usually met in pipe formulas), $\mu$ and $\rho$ the viscosity and density of the fluid, and $d$ the diameter of the particles constituting the packing. This last factor implies the fact that the "average conduit diameter" through the packing is of the order of the size of materials used. The data presented by the above investigators cover a wide range and show a good degree of correlation using Formula (4). For turbulent and viscous flow, the energy losses have been found to be, respectively,

$$\frac{\Delta P}{L} = \frac{k_1\, A_f\, \mu^{0.15}\, (\rho\, u)^{1.85}}{\rho\, d^{1.15}} \qquad (5a)$$

and

$$\frac{\Delta P}{L} = \frac{k_2\, A_f\, \mu\, u}{d^2} \qquad (5b)$$

The factor $A_f$ is called the "wall factor" where the ratio of particle diameter to the column diameter is very small. This factor was first used by Furnas and has been mathematically evaluated by him over a wide range of conditions. However, in most practical cases the correction is not needed.

### No Fractional Free Space Factor Included

Equations (4) and (5) are remarkable since the fractional free space discussed above is not included. Such a correction is undoubtedly necessary because the packing conditions may vary over a wide range and affect the energy losses. Chilton and Colburn did, as has already been stated, take some account of this correction term by assuming the flow to take place through a succession of orifices, but were compelled to use the forms above, since an evaluation of the factors involved was impossible.' These investigators further pointed out that Furnas' correlation of the factor $F$ with $f$ and other measurable parameters of the packing is not good, although it does seem that some such correlation should exist. If this is the case, then there is reason to presume that the factor $f$ may adequately account for the losses incurred by the

arrangement of the materials in the packed column.

As a matter of interest, Equation (4) may be shown to be identical to Burke's and Plummer's Equation (1), when $n$ is put equal to 1. This gives

$$\frac{\Delta P}{L} = k \frac{1}{f^3 (1-f)} u \mu S^2 \qquad (2')$$

Now $S$, which denotes the total area of particles (assumed spherical) per cubic centimeter, may be expressed by the equation

$$S = \frac{6(1-f)}{d} \qquad (6)$$

Substituting this in Equation (2') above, we obtain

$$\frac{\Delta P}{L} = k \left(\frac{1-f}{f^3}\right) \left(\frac{u \mu}{d^2}\right) \qquad (2a)$$

which, with the exception of the correction factors $A_f$ and $(1-f)/f^3$, is identical to the equation expressing the same condition derived by Chilton and Colburn (5b)

$$\frac{\Delta P}{L} = k' A f \left(\frac{u \mu}{d^2}\right) \qquad (5b)$$

Although the methods of attack employed by both investigators, Burke and Plummer and by Chilton and Colburn, differed, both sets of data plot as indicated in Fig. 1. The assumption that the size of the conduits is of the order of the average diameter of the particles therefore appears warranted.

### Experimental Results

In the following paragraphs, the resistance of a moving column of air through a tubing packed with quartz particles ranging from 0.09 to 0.41 cm. in average diameter is considered. The size distributions of the various samples have been determined by actual measurement of a series of 200 particles of each sample. A 32 mm. and a 40 mm. Bausch and Lomb objective and a filar micrometer were used for the purpose. The data obtained are shown plotted on log-probability paper in Fig. 2. This procedure, which has been discussed by Hatch and Choate,[6] eliminates the use of screens as a method of size determination and gives a complete picture of the particle size distribution. The median diameter of each distribution is that obtained by reading the fifty per cent size. Following the methods used by these investigators, the average particle diameter, $d$, is obtained from the equation:

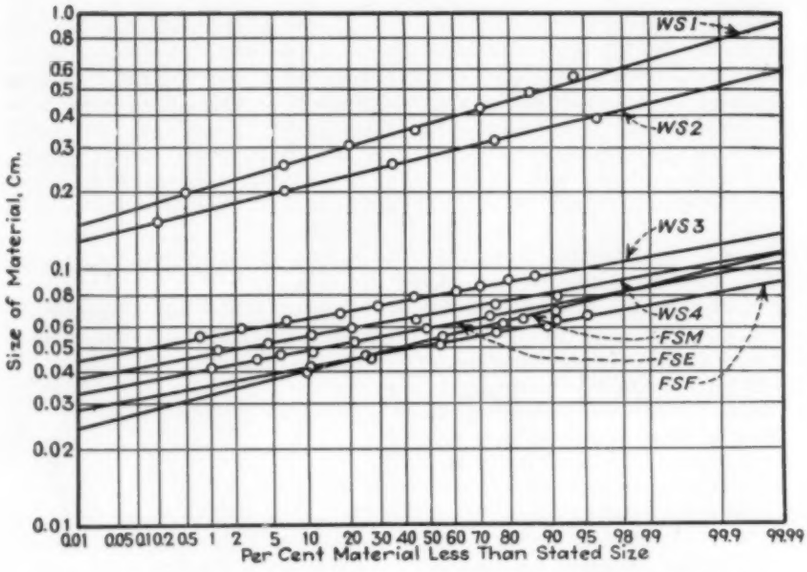



**Fig. 2—Particle size summation curves on a log-probability grid. From these curves the average particle diameter of the tower packing material may be obtained by the method of Hatch and Choate**

$$\log d^3 = \log m^3 + 10.3617 \log^2 \sigma \qquad (7)$$

where the logarithms are to the base 10 and $m$ is the median size taken from the summation curves of Fig. 2. The term $\sigma$ is defined as the geometric standard deviation and by the theory of the probability integral is given by the relation

$$\sigma = \frac{84.1 \text{ per cent size}}{50 \text{ per cent size}} = \frac{50 \text{ per cent size}}{15.9 \text{ per cent size}}$$

These values are also directly obtainable from the curves of Fig. 2.

Martin[7] has shown that the surface of an aggregate of irregular particles is always less than that determined from calculations based on their average diameter assuming the particles to be spheres. Thus, the surface of an aggregate of $N$-particles assuming them to be spheres would be

$$S' = \pi d^2 N \qquad (8)$$

while for particles of irregular shape

$$S = \alpha d^2 N \qquad (9)$$

where $\alpha$ is defined as the surface shape factor, and is always less than $\pi$.

Determinations of pressure drop were made as follows: A quantity of each material (crushed white sand) was placed in varying depths in a 3-in. diameter glass tube, and was shaken and tapped until it took up the minimum amount of space corresponding to a constant value of $f$. This factor was determined after each experiment by weighing the known volume of the packing and using the relation

$$f = \frac{\text{Density of quartz less apparent density of packing}}{\text{Density of quartz}}$$

Pressure losses through the packing were determined with a small static tube inserted near the top of the packing and connected to a sensitive manometer gage. The air used was taken from a pressure tank through a calibrated orifice meter and thence through a U-shaped tube near the top of the glass column in order to make the flow as uniform as possible over the surface of the packing. By using orifices sensitive over their respective ranges of flow, a wide selection of air velocities could be accurately determined. The plotted results of the pressure losses sustained by the air movement through various packings are shown in Fig. 3.

Data of Burke and Plummer based on stream line flow through spherical packings is given by Equation (3).

The determination of surface area per cubic centimeter, $S$, follows immediately by transposition

$$S = 1050\, f^{3/2}\, (\Delta P/L\, u)^{1/2} \qquad (10)$$

where the value of $\mu$ at 20 deg. C. is taken as 0.0182 centipoises. Values of $\Delta P/Lu$ experimentally determined for the packings investigated are given in Table I and are based on data plotted in Fig. 3.

**Table I—Values of ΔP/Lu for Streamline Flow Experimentally Determined**

| Sample No. | Actual measured values of $\Delta P/L\, u$ |
|---|---|
| WS1 | 0.0027 |
| WS2 | 0.0050 |
| WS3 | 0.0720 |
| WS4 | 0.0950 |
| FSE | 0.150 |
| FSF | 0.180 |
| FSM | 0.180 |

Table II presents the data used for computing $S$ and for determining the surface shape factor by substitution in Equation (9); that is,

$$\alpha = \frac{1050}{N\, d^2} f^{3/2}\, (\Delta P/L\, u)^{1/2} \qquad (11)$$

where, of course, $N$ is taken as the number of particles per cubic centimeter. The value of $N$ given in Table II is obtained by measuring the volume and weight of the aggregate tested, and by weighing and counting the particles of an aliquot. Thus,

$$\frac{\text{Volume of aggregate}}{\text{Weight of aggregate}} = \frac{\text{Volume of particles counted in aliquot}}{\text{Weight of particles comprising aliquot}};$$

and

$$\frac{\text{Number of particles in aliquot}}{\text{Volume of particles in aliquot}} = \frac{\text{Number of particles per cc. } (N)}{1 \text{ cc.}}$$

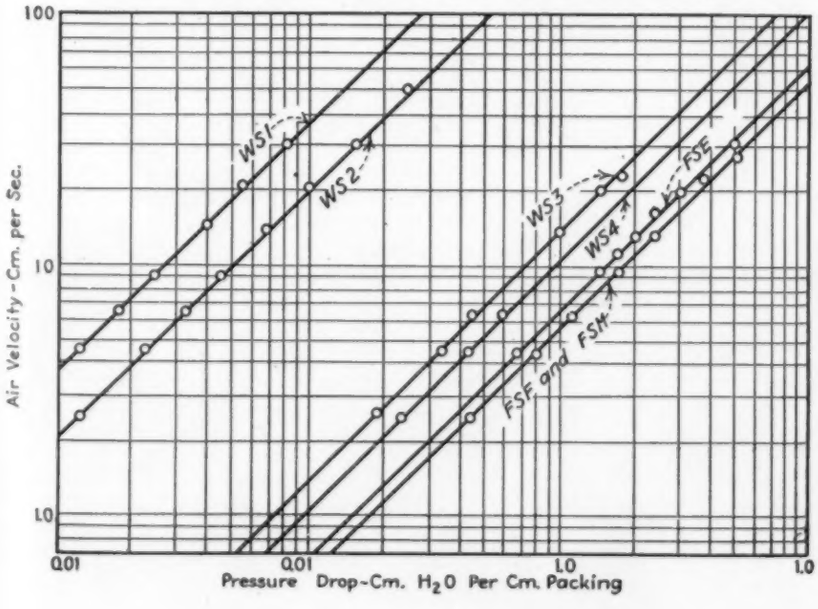
It may be seen from Table II that the value of $\alpha$ is in every case less than $\pi$. In passing, it is interesting to note that Equation (6) gives very high values of surface area. This is due to the fact that the particles studied cannot be assumed to be spheres.

Values of $\alpha$ in the last column indicate how great an error can be made in calculating the surfaces of an aggregate of irregular particles on the assumption that they may be considered as spheres of an equivalent average diameter. The results are similar to the results obtained by Martin. However, it must be pointed out that the use of the solubility technique by the latter is open to serious criticism, especially since the solubility rate is a function of particle size as well as of the character of the material used. The technique here presented, while dependent to a large extent on the correctness of the constants in Equation (3), is nevertheless more accurate and more universally applicable than any other method so far devised for determining surface.

**Table II—Properties of Sand Particles Tested for the Determination of Surface Area**

| Sample No. | Median ($m$), (cm) | Geometric Standard Deviation ($\sigma$) | Average Diameter ($d$), cm. | Fractional Voids ($f$) | No. Particles per cc. ($N$) | Value of S (Eqn. 10), cm²/cc | Surface shape factor (Eqn. 11) ($\alpha$) |
|---|---|---|---|---|---|---|---|
| WS1 | 0.38 | 1.28 | 0.41 | 0.335 | 30 | 10.5 | 2.6 |
| WS2 | 0.28 | 1.21 | 0.29 | 0.330 | 74 | 13.7 | 2.1 |
| WS3 | 0.078 | 1.14 | 0.08 | 0.318 | 2,710 | 49.4 | 2.9 |
| WS4 | 0.067 | 1.23 | 0.07 | 0.315 | 4,330 | 56.7 | 2.7 |
| FSE | 0.060 | 1.17 | 0.062 | 0.315 | 6,700 | 69.3 | 2.7 |
| FSF | 0.050 | 1.22 | 0.053 | 0.310 | 8,900 | 73.5 | 2.9 |
| FSM | 0.053 | 1.26 | 0.058 | 0.314 | 8,520 | 74.0 | 2.2 |

**Fig. 3—Air pressure drop through a 3-in. packed column filled with crushed white sand. Measurements were made in centimeters water gage per centimeter length of packing for air at 70 deg. in viscous motion**




## Summary

The resistance to the viscous flow of air through a quartz packing depends on the surface of the particles, $S$, and a packing factor, $f$, other things being constant. The recent work of Chilton and Colburn indicates that their equation for determining the resistance to flow through a granular packing is similar to the one proposed by Burke and Plummer although they are based on different assumptions. Of the two, Burke and Plummer's equation is the more exact and has been considered in greater detail with the present data. The results indicate that the surface shape factor ranges from a value of 2.1 to 2.9 and is always less than $\pi$, the shape factor for a sphere.

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# Sodium Chlorate Production

***This progress report on the electrochemical production of sodium chlorate supplements the previous contribution appearing in Chem. & Met.* Here, consideration is given to: (1) Improvements in cell design for lower power costs; (2) Continuous flow of electrolytes through a series of cells; (3) Relation of sodium chloride concentration to anode attack; (4) Effect of doubling current load on current efficiency, anode attack and costs; (5) Construction of a solubility diagram for the system sodium chlorate-sodium chloride-water; (6) Separation of sodium chlorate from electrolyte by (a) salt exchange, and (b) reduction of temperature.***

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IN THE ELECTROCHEMICAL PRODUCTION of sodium chlorate the energy consumption was reduced from 3.8 to 3.0 Kw.-hr. (a.c.) per pound of sodium chlorate crystals, a reduction of 9 per cent from the value previously reported. This was accomplished by changes in cell design. The chloride concentration in these cells could be reduced to 70–50 grams sodium chloride per liter before the rate of anode attack was increased significantly. Doubling the cell amperage in the new cells increased the anode replacement and power costs. This increase was offset by the decrease in investment costs. A solubility diagram was constructed for the system sodium chlorate-sodium chloride-water. The diagram has been shown to be useful in the estimation of crystallization yields by diverse methods. Crystallization by salt exchange requires the transfer of only a small fraction of the heat involved in separating sodium chlorate by other methods.

*Improved Cell Design*—The cells described in the earlier paper have been redesigned and in this investigation Fig. 1 represents cells No. 1 and 3, while Fig. 2 represents cells No. 2 and 4. The circular cathode type shown in Fig. 1 differed from the previous cells in the provision of wider spaces (from 3 in. to 6 in.) between anodes and the use of two auxiliary cathodes of imperforate sheets. The gap between anode and cathode was 1 inch. In cells No. 2 and 4 (Fig. 2), 24 auxiliary L-shaped cathodes were welded to each cell tank, thus forming cathode compartments. The electrode gap was closely ¾ inch on all sides. Both types were cooled externally by thermostatically-controlled water sprays.

Based on electrode potentials and the conductivity of 25 per cent brine, it was calculated that cells No. 2 and 4 when operating would show an initial overall potential drop of 2.80 volts: 1.28 volts from the anode to the solution; 0.12 volts through the solution; 1.30 volts from the solution to the cathode; and 0.10 volts for the leads from cell to cell and the contact drop from the anodes to the leads. Table I shows that cells No. 2 and 4 of the box-type cathode operated initially at 2.81 and 2.91 volts. Cells Nos. 1 and 3, Fig. 1 operated at somewhat higher initial voltages; namely, 2.87 and 3.0.

Previous to the operation of these four cells, a small cell was operated which showed 2.8 volts, 90 per cent current efficiency. The conditions were: "Y" graphite anode at 0.020 amp. per sq. cm., steel rod cathodes, at 0.016 amp. per sq. cm. arranged concentrically, one inch from the anode, pH of 6.3, trace only of lime.

**Table I — Electrolytic Cell Conditions in Continuous Operation***

| Cell No. | 1 | 2 | 3 | 4 | Av. Series | Total Series |
|---|---|---|---|---|---|---|
| Make of anodes | Y | Y | X-T | Y | | |
| Number of days run | 21 | 21 | 21 | 21 | ..... | ..... |
| Chlorate made (lbs.) | ..... | ..... | ..... | ..... | ..... | 1,585 |
| Amperage | 650 | 650 | 650 | 650 | 650 | ..... |
| Voltage: | | | | | | |
| (a) initial | 2.87 | 2.81 | 3.00 | 2.91 | ..... | ..... |
| (b) end† | 2.88 | 2.80 | 3.06 | 3.03 | ..... | ..... |
| (c) average‡ | 2.87 | 2.80 | 3.04 | 2.97 | ..... | ..... |
| Current density: | | | | | | |
| (a) anode (amp./sq.cm.) | 0.019 | 0.019 | 0.025 | 0.022 | ..... | ..... |
| (b) cathode (amp./sq.cm.) | 0.010 | 0.011 | 0.011 | 0.012 | ..... | ..... |
| Sodium dichromate hydrate, g./l. | 2 | 2.2 | 2.3 | 2.4 | ..... | ..... |
| Amperes per liter of solution | 1.11 | 1.11 | 1.09 | 1.09 | ..... | ..... |
| Temperature (°C.) | 32 | 32.1 | 32 | 32.5 | ..... | ..... |
| Hydrogen ion concn. (as pH) | 6.7 | 6.6 | 6.6 | 6.7 | ..... | ..... |
| Mols $NaClO_3$/1: | | | | | | |
| (a) initial | 1.07 | 2.11 | 3.19 | 4.37 | ..... | ..... |
| (b) end | 1.29 | 2.54 | 3.82 | 5.11 | ..... | ..... |
| (c) average | 1.16 | 2.32 | 3.50 | 4.74 | ..... | ..... |
| Mols NaCl/1: | | | | | | |
| (a) initial | 4.24 | 3.54 | 2.78 | 1.91 | ..... | ..... |
| (b) end | 3.90 | 2.92 | 1.97 | 1.03 | ..... | ..... |
| (c) average | 4.03 | 3.23 | 2.39 | 1.49 | ..... | ..... |

* This is but a portion of these runs selected because changes were not rapid.
† An anode broke off in Cell No. 3 during the course of the run.
‡ Voltage average is derived from the sum of daily values.

* *Chem. & Met.* Vol. 44, p. 302 (1937)

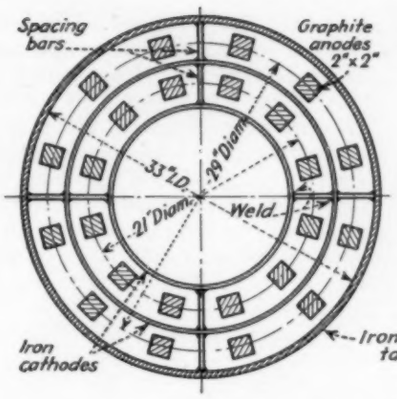
(Contribution from the Industrial Farm Products Research Division, Bureau of Chemistry and Soils, U. S. Department of Agriculture, Washington, D.C.)

2 grams of sodium dichromate per liter. These conditions closely approximated those in cells No. 2 and 4. From Tables I and II it is seen that the voltages in both the pilot cell and in No. 2 and 4 cells were practically the same. The current efficiencies, however, were 6.7 to 8.6 per cent lower in the large cells. Table II shows the four cells averaged 2.56 Kw.-hr. (d.c.) per pound of crystal sodium chlorate. This is equal to 3.0 Kw.-hr. (a.c.) per pound of crystals which is 9 per cent less than that required as shown in our first report. See footnote, Table IV.

*Continuous Flow Electrolysis*—Sodium chlorate cells have been previously operated both on the batch and on the continuous flow principle[2]. Schumann-LeClercq[3] has employed a system wherein several cells in series were connected to a pump and cooling coil to permit recirculation of the electrolyte.

Our equipment consisted of an elevated brine feed tank, a glass flowmeter, four cells, ½-inch diameter glass siphons between successive cells, and a glass-lined receiving tank. The brine flow was to cell No. 1, then to No. 2, 3 and 4 in the series. Iron fittings connected below the liquid level were used for the discharge from No. 4 cell and this line was provided with a vent to prevent siphoning. By means of a rubber coupling and a glass tube, the cell liquor was led to the receiver. The inlet side of each siphon extended below the level of the anode bottoms to prevent gases entering the siphons, the outlet ends of which were short and had the opening on the sides instead of in the end of the tube. Cells were cleaned of rust by an acid pickling, were rinsed, and charged with salt and chlorate solutions of appropriate strength. Twice a week, analyses of cell electrolyte and product were made; gas analyses were also made periodically. Table II, last column, shows the current efficiency was 82.8 per cent computed from gas analyses, 83.3 per cent from cell liquor analyses, which is good agreement. The product containing 4.74 mols (505 grams) of sodium chlorate per liter and 1.49 mols (87 grams) of sodium chloride per liter (Table I) flowed from No. 4 cell, the last in the series.

*Anode Attack vs. Sodium Chloride Concentration*—For these experiments, cells No. 1 and 2 were operated in batch fashion at 1,300 amperes each. Liquid levels were maintained with distilled water. As



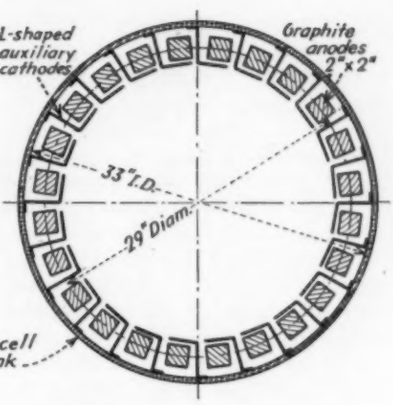




**Fig. 1**—Horizontal section, cells No. 1 and 3
**Fig. 2**—Horizontal section, cells No. 2 and 4

**Table II — Continuous Operation: Efficiencies, Graphite Consumption**

| Cell No. | 1 | 2 | 3 | 4 | Total Series |
|---|---|---|---|---|---|
| Electrodes | Y | Y | X-T | Y | ..... |
| Current efficiency: | | | | | |
| (a) from cell liquor analyses | ..... | ..... | ..... | ..... | 83.3 |
| (b) from gas analyses | 84.5 | 83.2 | 80.5 | 81.4 | 82.8 |
| Kw.-hr./lb. sodium chlorate: | | | | | |
| (a) from cell liquor analyses | ..... | ..... | ..... | ..... | 2.55 |
| (b) from gas analyses | 2.46 | 2.43 | 2.73 | 2.63 | 2.56 |
| Weight of anodes (lb.) | 216 | 214 | 178 | 181 | ..... |
| Calcd. weight loss (%)* | 1.7 | 1.7 | 1.3 | 2.8 | ..... |
| Lb. graphite lost/ton chlorate in soln. based on 30% machined wt. as stump loss* | 26 | 26 | 17 | 37 | ..... |

* Estimated: Based on the loss as carbon dioxide, plus an assumed sludge loss equal to the loss as carbon dioxide.
Chlorate produced in solution was 1,585 lb. for the four cells = 83.3%. Individual yields by gas analyses showed 82.8% current yield.

electrolysis proceeded, the per cent carbon dioxide in the cell gases, which is a measure of anode attack, was plotted against diminishing sodium chloride concentration. The increase in attack was rather slight until the salt was reduced to about 70–50 grams sodium chloride per liter. At 30 grams, the attack had increased by 200 to 300 per cent. The increase in attack was more rapid at lower salt concentrations.

*Operation at Double the Cell Load*—More productive cells are possible when higher current densities can be used on the electrodes. For the present purpose the cell interest and depreciation charges are considered inverse to the anode current density.

No. 1 and 2 cells were operated on a batch basis at 1,300 amperes, the electrolyte level being kept constant by the addition of distilled water. The double load doubled the current concentration, (amperes per liter of electrolyte, as well as the current density at the electrodes. Table III, column 7, shows a 0.3 volt increase in No. 2 cell, but showed no significant change in current efficiency. The power for this cell increased from 2.32 to 2.52 kw.-hr. (d.c.) per pound of dissolved sodium chlorate. See column 8. The anode attack, column 9, increased from 1.8 to 2.9 grams or 1.1 grams increase in carbon loss for double the current. We do not have data for an accurate comparison of anode attack vs. load in cell No. 1 of the circular cathode type at 100 grams sodium chloride per liter since there is no data for anode attack at 650 amperes load and the above concentration of salt. However, the attack was 1.8 grams carbon per pound of sodium chlorate when the salt was 250 grams sodium chloride per liter at 650 amperes load. The attack would have been the same or more at 100 grams per liter. In column 9, Table III, it will be noted that No. 1 cell shows 1.8 grams carbon loss by attack per lb. chlorate at 1,300 amperes and 100 grams salt per liter. This indicated no change in attack with load for No. 1 cell in the range of conditions covered. This difference in the effect of load on No. 1 and 2 cells is apparently related to the difference in cell construction and may be due to a high effective current concentration in the L-shaped compartments.

In Table IV, columns 5, 9, and 10, consideration is given to certain financial charges or burdens relating to the construction and operation of the cell room. These are power cost, graphite replacement, and cell and building interest and depreciation costs. Derivations of these costs are given in the footnotes for the table. The sum of the three separate costs is given in column No. 11 which shows that there is no significant difference in the sum of the costs for No. 2 cell when doubling the load. With the double load, the financial risk of the cell investment would be cut in half.

*Preparation of a Solubility Diagram: Sodium Chlorate-Sodium Chloride-Water*—Various methods have been described for separating sodium chlorate from cell liquors. Lederlin,[7] operating at 75 deg. C. and using platinum anodes, produced a cell liquor of 49 deg. Be. containing 750 grams sodium chlorate and 120 grams sodium chloride per liter, from which he crystallized sodium chlorate by cooling till the solution, through crystallization, was reduced to 36 deg. Be., with a content of 450 grams sodium chlorate per liter. With graphite anodes and lower cell temperatures, Bunet,[4, 8] made a cell liquor of 450–500 grams sodium chlorate per liter which he first concentrated to 47 deg. Be. The salt which was precipitated was filtered out hot, and the sodium chlorate was then crystallized by subsequent cooling.

Winteler,[11] reported the solubility at 20 deg. C. for the three-component system sodium chloride-sodium chlorate-water. Wu,[12] measured the solubility of sodium chloride in saturated solutions of sodium chlorate, 60–100 deg. C., but miscalculated his results. The International Critical Tables give summaries of data which are ample for the two-component systems: sodium chlorate-water and sodium chloride-water. To complete the solubility data in enough detail for technical use, further solubilities were measured by us.

The apparatus used in the solubility work is shown in Fig. 3. A standardized thermometer with 0.2 deg. C. graduations, and a sealed, adjustable mercury regulator controlling current to an immersion heater were used to measure and control the temperature of the solubility flask at 25 deg. and 40 deg. C. An ice bath was used to maintain a temperature of 0 deg. C. Solubilities have been expressed in grams of solute per 100 grams of water. Sodium chloride solubilities have been plotted as the ordinates and sodium chlorate solubilities as the abscissas as shown in Fig. 4. The 100 deg. C. isotherm is *QRS*. Unsaturated solutions lie in the area *QRSX*. Points on the line *QR* represent the composition of solutions in equilibrium with solid sodium chloride. At *R* both solid salts are present. This point is on the line *RR'* which represents the composition of all systems in equilibrium with both solid salts in the temperature range, 0–100 deg. C. An increase in chloride content of the solution (by solution of solid salt) would be represented by an upward movement from any starting point along an ordinate parallel to *XQ*. Sodium chlorate crystallization without evaporation would be represented by a movement to the left along a line parallel to *XS*. Dilution is represented by a movement from any starting point along a line directly towards *X*. Evaporation is just the reverse, away from *X*.

To evaluate the reliability of the solubility data and to study some crystallization possibilities quantitatively, two groups of experiments have been carried out as follows:

(1) Crystallization by cooling
  (a) Without evaporation
  (b) With evaporation

Fig. 3—Apparatus used in solubility work

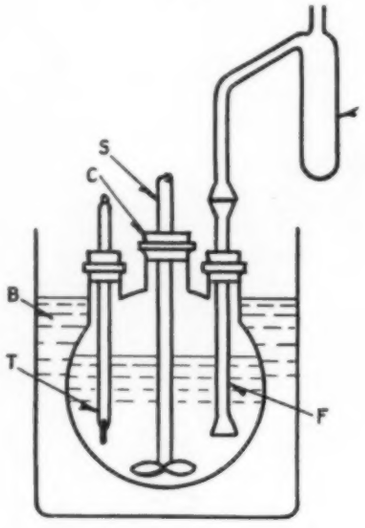



**Table III — Effect of Current Load at a Concentration of 100 Grams Sodium Chloride per Liter**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8* | 9* | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| Cell number | Amps. | % Current loss in formation of $CO_3$ | % Current loss in formation of $O_2$ | Current efficiency, Anode | Current efficiency, Cathode | Voltage | Kw.-hr. (D.C.) /Lb. $NaClO_3$ | Grams carbon as $CO_3$/Lb. $NaClO_3$ | Temperature deg. C. | $H^+$ Ion as pH |
| 2..... | 650 | 2.0 | 9.0 | 89 | 95 | 2.84 | 2.32 | 1.8 | 30.8 | 6.4–6.8 |
| 3..... | 650 | 1.5 | 7.8 | 91 | 94 | 3.05 | 2.47 | 1.4 | 32.0 | 6.3–6.6 |
| 4..... | 650 | 2.0 | 6.0 | 92 | 94 | 2.97 | 2.37 | 1.8 | 32.2 | 6.8 av. |
| 1..... | 1,300 | 2.0 | 6.8 | 91 | 94 | 3.25 | 2.62 | 1.8 | 32.0 | 6.3–6.4 |
| 2..... | 1,300 | 3.2 | 6.8 | 90 | 95 | 3.12 | 2.52 | 2.9 | 31.8 | 6.4–6.5 |

* The basis is per pound of sodium chlorate in solution.

**Table IV — Comparison of Some Operating Costs at 100 Grams Sodium Chloride per Liter**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| Cell number | Amps. | Kw.hr.(D.C.) /Lb. $NaClO_3$ in sol. | Kw.-hr.(A.C.) /Lb. $NaClO_3$ as crystals | Power cost /Lb. $NaClO_3$, mills | Graphite loss /Lb. $NaClO_3$, grams | Graphite loss /Lb. $NaClO_3$, pounds | Graphite loss /Ton $NaClO_3$, pounds | Cost, graphite /Lb. $NaClO_3$, mills | Cost, cell + bldg./Lb.$NaClO_3$ mills | Sum of three costs, mills |
| 2..... | 650 | 2.32 | 2.89 | 8.8 | 1.8 | 0.0042 | 24.0 | 1.7 | 3.1 | 13.7 |
| 3..... | 650 | 2.47 | 3.08 | 9.4 | 1.4 | 0.0032 | 18.6 | 1.5 | 3.1 | 14.1 |
| 4..... | 650 | 2.37 | 2.95 | 9.0 | 1.8 | 0.0042 | 24.0 | 1.7 | 3.1 | 13.9 |
| 1..... | 1,300 | 2.62 | 3.26 | 9.9 | 1.8 | 0.0042 | 24.0 | 1.7 | 1.6 | 13.2 |
| 2..... | 1,300 | 2.52 | 3.14 | 9.6 | 2.9 | 0.0067 | 38.6 | 2.7 | 1.6 | 13.9 |

Power — The conversion loss, A.C. to D.C., is 12%; bus bar losses, 4%; purification of chlorate loss, 5%. The cost of power, A.C., is 3.05 mills/Kw.-hr. See Table III of reference (1).

Graphite — Mechanical loss is assumed equal to the chemical loss measured. Loss in the stumps of anodes left is taken at 30% of the original graphite weight. Graphite costs are taken as 14.25 cents/lb. for "Y" graphite, which is untreated; and 16.25 cents / lb. for "X-T" graphite which is treated.

Cell and Building Cost — cell and building costs ref. (1), less anode costs of $45 per cell yield a cost of 2.3 mills / lb. of sodium chlorate. The foregoing cells were rated at 865 amperes load each. This cost in Table IV is assumed to be inversely proportionate to the cell load.

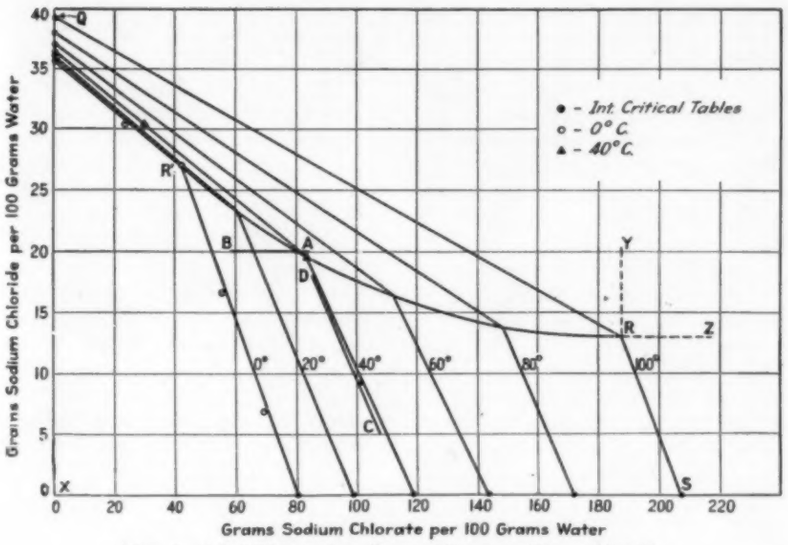



Fig. 4—Solubilities of sodium chlorate-sodium chloride mixtures in water

**Table VI — Analyses of Solutions Saturated With NaCl and $NaClO_3$**

Temperature 0° to 40° C. Solid Phases = NaCl + $NaClO_3$

| Temperature Deg. C. | Analysis (%) $NaClO_3$ | NaCl | $H_2O$ | Approach to equilibrium from Deg. C. |
|---|---|---|---|---|
| 0 | 23.97* | 16.42 | 59.61 | 30 |
| 0 | 25.03 | 15.95 | 59.02 | 40 |
| 0 | 25.02 | 15.99 | 58.99 | 25 |
| 0 | 24.67 | 16.10 | 59.23 | 25 |
| 0 | 24.92 | 15.92 | 59.16 | 0 |
| 0 | 24.88 | 15.82 | 59.30 | 0 |
| Average | 24.90 | 15.96 | 59.14 | 0 |
| 25 | 34.80 | 12.05 | 53.15 | Above 25 |
| 25 | 35.05 | 11.85 | 53.10 | Below 25 |
| 25 | 34.99 | 11.88 | 53.13 | Below 25 |
| 25 | 34.94 | 11.83 | 53.23 | Below 25 |
| 25 | 35.02 | 11.86 | 53.12 | Below 25 |
| 25 | 35.04 | 11.81 | 53.15 | Below 25 |
| Average | 34.97 | 11.88 | 53.15 | |
| 40.25 | 41.10 | 9.53 | 49.37 | Below 40° C. at start. |
| 40.25 | 41.39 | 9.59 | 49.02 | Samples taken on one lot on successive days. |
| 40.25 | 41.11 | 9.68 | 49.21 | |
| 40.25 | 41.23 | 9.60 | 49.17 | |
| Average | 41.21 | 9.60 | 49.19 | |

* Omitted from average.

(2) Isothermal crystallization by solution of sodium chloride. The first subdivision of (1) represents cooling and crystallization by the judicious use of water, brine, or a combination of the two. The second subdivision of (1) represents conditions met in vacuum evaporative crystallizers,[14]. In these crystallizers, the heat for evaporation is derived from the heat content of the boiling solution.

The results of some crystallization experiments are shown by the data in Table VIII. In all these experiments, crystals were separated by filtration from the residual liquor; no wash water was used. These crystals were wet with adhering mother liquor. Correction was made for the water, sodium chloride and sodium chlorate due to the mother liquor adhering to the wet crystals.

Experiments No. 1 and 2, Table VIII, are illustrative of crystallization by cooling alone. In the first experiment, the analysis at the start was 83.5 grams $NaClO_3$ and 19.7 grams NaCl per 100 grams $H_2O$. This analysis is represented by point A, Fig. 4. When the solution was cooled, the final temperature was 8 deg. C. The analysis at the end showed 19.7 grams NaCl and 58 grams $NaClO_3$ per 100 grams $H_2O$. This is represented by point B. Interpolation shows that point B would lie on an 8 deg. C. isotherm. In experiment 2, two lots of solution weighing 29 Kg. each were used. Both these latter lots were cooled in a cold storage chamber of controlled and recorded temperature. Part (a) was removed at the end of 24 hours; and (b) at the end of 48 hours.

The yield obtained by cooling the solution in this manner is increased through the concentration of the solution by the evaporation of part of the water[17]. This was included in the estimation of yields. Sodium chloride is regarded as the unchanged constituent in the solution and serves to relate the original and expected final solution anlyses. Because of supersaturation of sodium chlorate, it was found necessary to speed up crystallization by equipping the Dewar flask used for an evaporator with an agitator, and to start runs with the previous addition of weighed seed

**Table V — Analyses of Solutions Saturated With Respect to Both NaCl and $NaClO_3$**

(Wu, recalc'd)

| Temperature Deg. C. | Analysis (%) $NaClO_3$ | NaCl | $H_2O$ |
|---|---|---|---|
| 60.3 | 49.24 | 7.22 | 43.54 |
| 60.3 | 49.21 | 7.22 | 43.57 |
| Average | 49.23 | 7.22 | 43.55 |
| 75.8 | 55.03 | 5.74 | 39.23 |
| 86.8 | 58.65 | 4.92 | 36.43 |
| 86.3 | 58.54 | 4.94 | 36.52 |
| Average | 58.59 | 4.93 | 36.48 |
| 98.8 | 62.42 | 4.39 | 33.19 |
| 98.8 | 62.04 | 4.41 | 33.55 |
| Average | 62.23 | 4.40 | 33.37 |

crystals in order that estimated and experimental yields agree within reasonable limits. The boiling-point rise, (B.P.R.), at the end of these cooling experiments was found to be 14–16 deg. C.

Isothermal experiments were carried out in which the effect of the addition of solid sodium chloride on sodium chlorate crystallization was measured. In Experiment 4, Table VIII, the added sodium chloride was intentionally less than that required to bring the solution composition to one in which both solid salts would be present at equilibrium. The sodium chloride in the dried crystals was due chiefly to adhering solution on the wet crystals. The analysis at the start was 108 grams $NaClO_3$ and 5 grams NaCl per 100 grams $H_2O$. See point C, Fig. 4. This was slightly under saturation at 40 deg. C. Then, when all the added solid sodium chloride had dissolved, causing crystallization of sodium chlorate, the solution's analysis should have been shown by point D on the 40 deg. C. line. This was read from an enlarged plot as 85.5 grams $NaClO_3$ per 100 grams $H_2O$. The estimated yield is

(108–85.5)/108 = 20.8 per cent. Experiment 4 gave 85.0 grams $NaClO_3$ per 100 grams $H_2O$ for a final solution analysis and a yield of 21 per cent. In Experiments 5 and 6 the concentration was 10 grams NaCl per 100 grams $H_2O$. In Experiment 5 there was added solid sodium chloride in a quantity estimated to be undissolved in part at equilibrium, which analysis confirmed. In Experiment 6, part of the foregoing supernatant liquor was removed, and an equal weight of fresh liquor of the original composition was added. Further agitation resulted in dissolving this excess of solid sodium chloride. This shows that if in practice too much salt should be added, giving an impure sodium chlorate crystal mass, purification could be easily brought about.

The maximum calculated solid sodium chloride content of any lot of wet crystals in the foregoing experiments was 0.2 per cent.

*Separation of Sodium Chlorate: Calculations*—It is of interest to compare the thermal requirements for three methods of effecting sodium chlorate crystallization, viz: concentration, refrigeration and salt exchange. For the comparison of these methods, use was made of a composition representative of the cell effluent, viz: 90 grams sodium chlorate, 10 grams sodium chloride, and 100 grams water. Such a solution is saturated with sodium chlorate at 30 deg. C.

The concentration method consists of: evaporation, hot filtration of sodium chloride crystallized during concentration, cooling to 30 deg. C. to effect crystallization of sodium chlorate, and finally the separation of the sodium chlorate crystals. The steam requirement has been computed as 690 pounds per 1000 pounds of sodium chlorate crystals, assuming the use of a double-effect evaporator. In the above process, one crop of crystals is taken before returning the solution to the cells. The heat required as steam is 670 B.t.u. per pound of sodium chlorate, no allowance being made for any thermal losses, or steam for evaporation of wash waters used in purifying the crystal crop. Allowance is made for heating the solution, assuming a specific heat of 0.6. The main heat demand is for evaporation. A second crop by a double-effect evaporation would require 760 pounds of steam per 1,000 pounds of chlorate.

Crystallization by refrigerative cooling from 30 deg. C. to 0 deg. C. yields a 26.7 per cent crop of sodium chlorate. Vacuum cooling, however, is not practical over this range. When water is cooled by this process, high efficiencies are not obtained below 5 deg. C. Since the B.P.R. for the chlorate liquor is 10 deg. C. or more, than 15 deg. C. would be the lowest practical temperature to which the solution could be cooled efficiently by closed evaporative cooling. With a specific heat of 0.6 assumed for the solution, the heat removal is 270 B.t.u. per pound of sodium chlorate crystals produced, or one ton refrigeration per 1,000 pounds.

In isothermal crystallization by "salting out," the maximum yield, 22 per cent, results when the composition of the solution is brought to the intercept of *RR'* with the 30 deg. C. isotherm by the addition of salt (Fig. 4). Any additional sodium chloride crystals would remain undissolved, and their presence would result in an impure crop of sodium chlorate. In order to effect isothermal crystallization the heat of solution of sodium chloride and the heat of crystallization of sodium chlorate must be compensated. These values are not known precisely, but are known to be small, and it is estimated that the heat to be compensated for would be not far from 50 B.t.u. per lb. $NaClO_3$ crystallized.

**Table VII — Analyses of Solutions Saturated With Respect to Either NaCl or $NaClO_3$**

Temperature 40° C.

| Solid Phase | Temperature Deg. C. | Analysis (%) $NaClO_3$ | NaCl | $H_2O$ | Approach to equilibrium from Deg. C. |
|---|---|---|---|---|---|
| NaCl | 0 | 15.6 | 19.7 | 64.7 | 25 |
| NaCl | 0 | 15.5 | 19.7 | 65.8 | 0 |
| Average | | 15.55 | 19.7 | 65.2 | |
| $NaClO_3$ | 0 | 31.78 | 9.69 | 58.53 | 25 |
| $NaClO_3$ | 0 | 32.35 | 9.61 | 58.04 | 0 |
| Average | | 32.06 | 9.65 | 58.29 | |
| $NaClO_3$ | 0 | 39.65 | 3.79 | 56.56 | Room |
| $NaClO_3$ | 0 | 39.39 | 3.86 | 56.75 | 0 |
| Average | | 39.5 | 3.83 | 56.66 | |
| NaCl | 25 | 16.21 | 19.56 | 64.23 | Samples taken on one lot on successive days. |
| NaCl | 25 | 16.29 | 19.41 | 64.25 | |
| NaCl | 25 | 16.20 | 19.55 | 64.25 | |
| Average | | 16.23 | 19.51 | 64.24 | |
| NaCl | 25 | 34.94 | 11.83 | 53.23 | Samples taken on one lot on successive days. |
| NaCl | 25 | 35.02 | 11.86 | 53.12 | |
| NaCl | 25 | 35.04 | 11.81 | 53.15 | |
| Average | | 35.00 | 11.83 | 53.17 | |
| $NaClO_3$ | 40.25 | 47.84 | 4.43 | 47.73 | 75 |
| $NaClO_3$ | 40.25 | 47.90 | 4.43 | 47.67 | 40 |
| Average | | 47.87 | 4.43 | 47.70 | |
| $NaClO_3$ | 40.25 | 16.02 | 19.55 | 64.43 | 40 |
| $NaClO_3$ | 40.25 | 15.90 | 19.70 | 64.40 | 40 |
| Average | | 15.96 | 19.62 | 64.42 | |

**Table VIII — Sodium Chlorate Crystallization**

| | Conc. per 100 gm. $H_2O$ Start | | End | | Temp. Deg. C. | | Analysis Wet Crystals | | % Yield | |
|---|---|---|---|---|---|---|---|---|---|---|
| Exp. | $NaClO_3$ | NaCl | $NaClO_3$ | NaCl | Initial | Final | $\%H_2O$ | % NaCl Dry basis) | Est. | Found |
| 1 | 83.5 | 19.7 | 58.0 | 19.7 | 40+ | 8.0 | 2.3 | 0.56 | 31 | 33 |
| 2a | 85.0 | 21.1 | 50.5 | 20.4 | 70 | 4.0 | 4.7 | 1.58 | 38 | 37 |
| 2b | 85.0 | 21.1 | 51.1 | 20.3 | ..... | 4.0 | 3.8 | 1.87 | 38 | 38 |
| 3a | 80.0 | 20.0 | ..... | ..... | 40.5 | 25.0 | 10.0 | 2.38 | 20 | 20 |
| 3b | 80.0 | 20.0 | ..... | ..... | 41.5 | 23.5 | 3.75 | 0.99 | 22 | 21 |
| 4 | 108.0 | 5.0 | 85.0 | 18.0 | 40.0 | 40.0 | 6.0 | 1.20 | 21 | 21 |
| 5 | 98.5 | 10.0 | 84.4 | 19.6 | 40.3 | 40.3 | 4.5 | 14.95 | 15 | 15 |
| 6 | 98.5 | 10.0 | 94.0 | 12.9 | 40.4 | 40.6 | 5.0 est. | 0.72 | 15 | 14 |

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# Chemical Engineer's BOOKSHELF

## New Titles, Editions and Authors

### UNIT PROCESSES UP-TO-DATE

UNIT PROCESSES IN ORGANIC SYNTHESIS. Second Edition. Edited by *Philip H. Groggins*. Published by the McGraw-Hill Book Co., Inc., New York, N. Y., 1938. 769 pages. Price, $6.

Reviewed by *Kenneth H. Klipstein*

THE MAJORITY of commercially important organic syntheses are outlined and classified in this volume. The title term, "unit processes," indicates that types of chemical reactions are treated rather than types of physical operations, which are covered by the term "unit operations." The former have to do with the chemical and physical factors affecting such processes as nitration, diazotization, esterification and hydrolysis, whereas the latter refer to mixing, drying, distillation and similar operations.

The first edition of Groggins was published in 1935. During the three years which have elapsed both the response it received and the progress which has been made in the field have justified a second and enlarged edition. Increased emphasis has been placed on the synthesis of aliphatic compounds, and the section dealing with polymerization has been substantially augmented in keeping with recent industrial trends. Other sections have been elaborated to render them more complete. For example, factors affecting coupling have been included under the general heading of diazotization, significant details of the newer commercial applications of the Friedel and Crafts reaction have been incorporated, a discussion of the thermodynamic principles has been added, and a substantial number of new flow sheets are to be noted.

The book fills a gap left by the more specialized texts on organic and physical chemistry and chemical engineering. Fundamental and theoretical considerations are discussed, but only to the extent that they are directly applicable to industrial syntheses. The successful operation of chemical processes on a plant scale involves detail of control of quality and proportions of raw materials, conditions of reactions, time cycles, and design of equipment far beyond the scope of any single book. Enough important data, however, have been included, based on commercial practise and on adequate laboratory experimentation, to impart an intelligent comprehension of many of the processes described.

The book should continue to be helpful particularly to students in chemistry who plan to go into industry, and to those who are already engaged in industry who are anxious to obtain a general knowledge of fields other than the particular one in which they specialize.

### THE OTHER HALF OF THE PROBLEM

CHEMICAL ENGINEERING ECONOMICS. Second Edition. By *Chaplin Tyler*. Published by the McGraw-Hill Book Co., Inc., New York, N. Y., 1938. 241 pages. Price, $3.

Reviewed by *C. R. DeLong*

THE AUTHOR opens the preface to this second edition with the statement that "Tremendous advances have occurred during the twelve years since the first edition." It is obvious after careful reading that the author has kept fully abreast of these advances.

The work has been expanded by new chapters on sales development and sales, patents, and industry and the chemical engineer. A large part of the statistical analysis of the chemical industry has purposely been omitted. However, it has been replaced by a detailed tabulation of the sources of statistical data and of commercial information which is of much more value than statistics themselves for workers in this field.

The chapter on development of chemical engineering projects has been expanded into two chapters: Research and Development and Project Analysis. The latter, which deals with the determination of the commercial feasibility of new products and processes, i.e. will they yield an adequate return on the capital investment, should be read by every chemical engineer.

The addition to the chapter, Unit Operation Costs, of typical costs of unit operations, raw materials, packing, storage, labor and of general expenses, will be found extremely valuable in preliminary cost estimates of new projects.

It is obvious that the author has drawn on his industrial experience to enable him to drive home his points with concrete facts and examples. This one thing alone makes the new edition worth reading even by those thoroughly familiar with the first edition. Our brethren who have little faith in our capitalistic system might open their eyes if they knew that on the average $8,500 of capital investment is required to create one new job in the chemical industry.

If every chemical engineer, chemist and chemical executive were somehow made to read this second edition of "Chemical Engineering Economics" each would have a better appreciation of the others' responsibilities.

### SOLVENT USER'S GUIDE

SOLVENTS. By *Thomas H. Durrans*. Published by D. Van Nostrand Co., Inc., New York, N. Y., 1938. 232 pages. Price, $5.

Reviewed by *George F. Osborne*

TO FULFILL the impression given by the title and to be of real practical value, a book on solvents should provide: (1) an explanation of the role played by each commonly used solvent to serve as a guide in formulating a solvent combination having specific properties and (2) data on physical properties such as boiling point, specific gravity, solvency, etc.

Probably a little more theoretical material relative to the function of solvents is presented in this book than is absolutely necessary for practical formulating purposes, but this additional information detracts in no way from the clarity of the explanation. Instead, the author, apparently anticipating many questions, has skillfully blended the correct type and amount of theoretical information with the practical to make a clear and straightforward presentation that does not in the least resemble the cook book method. The material is carefully arranged and so completely indexed that the answer to a specific question can be found immediately.

A wealth of information on general physical properties is also included, thus adequately taking care of the second point that should be met. There are two chapters devoted to the general subjects of inflammability and toxicity, properties that must now be considered more seriously.

The second part of the book deals with the various solvents considered individually but grouped in chapters according to their chemical composition or use. Specific information is given on impor-

tant physical characteristics. The list is very complete, even including solvents most recently made commercially available.

## SENSE ABOUT DOLLARS

PRINCIPLES OF ENGINEERING ECONOMY. By *Eugene L. Grant*. Published by The Ronald Press Co., New York, N. Y., 1938. 431 pages. Price, $3.75. Problems supplement, 142 pages, $1.

Reviewed by *Theodore M. Switz*

EVERY engineering problem is eventually reduced to a dollars and cents basis, though cost may not be the ultimate deciding factor. Yet, even engineers who have been in industry for years have usually only a limited view of engineering economics.

The author, who is associate professor of economics of engineering at Stanford, has been working in this field for 20 years. The present book is a complete reorganization of the first edition which appeared in 1930. It is easy to read and the general principles are clarified by many good examples which the business man will recognize as typical.

Professor Grant points out that top management, in considering any engineering proposal, will want answers to these three questions: 1. Why do it at all? 2. Why do it now? 3. Why do it this way? His chapters on the Time Value of Money, an essential factor in answering such questions, are particularly noteworthy.

Anyone who has to make business decisions based on engineering facts will find this book stimulating and helpful.

## FLUID TECHNOLOGY

THERMODYNAMICS, FLUID FLOW AND HEAT TRANSMISSION. By *Huber O. Croft*. Published by the McGraw-Hill Book Co., Inc., New York, N. Y., 1938. 312 pages. Price, $3.50.

Reviewed by *C. C. Monrad*

AN UNUSUAL selection of topics is covered in this book. In addition to those stated in the title, the subjects of dimensional analysis, theory of similitude, fluid measurement and movements of particles in fluids are discussed.

Since this book is mainly for mechanical engineers, the thermodynamic treatment is not as comprehensive as will be desired by chemical engineers. In addition, applications of thermodynamics are stressed at the expense of a fundamental discussion of principles, which the author assumes has been obtained earlier by the reader.

The chapters on fluid flow and fluid measurement should be of considerable interest to all engineers as the treatment is sufficiently broad to permit applications in quite diverse fields. The discussion of dimensional analysis and the theory of similitude includes applications to fields outside of those usually encountered by chemical engineers.

The chapter on heat transmission is quite complete and up to date, including some of the most recent work in this field. The main criticism the reviewer has of the treatment in this chapter is that formulas are stated without much critical analysis of the data behind them or discussion of the limitations of the equations themselves. For example, an equation is proposed for condensation from air-steam mixtures which is based on one set of experimental data and which clearly is not generally applicable.

The author has attempted to clarify the unfortunate situation in the English system where pounds are used both for force and for mass, by using pounds for force only. It appears to the reviewer that the net result is more confusing than ever, since, for example, specific volume becomes the volume occupied by unit weight rather than by unit mass.

On the whole the book should be of considerable value as a reference on the subjects covered, provided the reader has had previous training in the fundamental principles involved.

## COLLOIDAL SALTS

INORGANIC COLLOID CHEMISTRY, VOL. III —THE COLLOIDAL SALTS. By *Harry B. Weiser*. Published by John Wiley and Sons, Inc., New York, N. Y., 1938. 473 pages. Price, $6.

Reviewed by *Harry N. Holmes*.

THE LAST in a three-volume treatise on inorganic colloid chemistry, this book covers mainly the colloidal sulphates, halides, sulphides, ferrocyanides, and silicates. The previous volumes were "The Colloidal Elements" (1933), and "The Hydrous Oxides and Hydroxides" (1935).

The author's interest in barium sulphate sols is expressed in many pages of clearly written discussion of von Weimarn's work, of various preparations of positive and negative sols, of methods of recognizing the charge, and of the influence of alcohols on the sols. Measurment of the extent of surface on lead sulphate by Paneth's method and by dye adsorption receives adequate attention. Plaster of Paris brings in the mechanism of setting and evidence for the existence of calcium sulphate hemihydrate.

Under colloidal lead chromate the author quotes several opinions as to the variations in color. The treatment of adsorption of ions by the silver halides is excellent. Verwey and Knight are quoted as showing that iodide ion is not adsorbed over the entire surface but only at certain active spots on the surface. Several pages are devoted to the colloidal characteristics of the silver halides in photography.

The post-precipitation of zinc sulphide on precipitated copper sulphide under certain conditions of acidity, temperature, and time is entertainingly discussed. The fact that cupric sulphide is almost as good an electrical conductor as metallic bismuth was new to the reviewer. The brief discussion of electrostenolysis, however, reminded the reviewer of his own paper published in the *Journal of the American Chemical Society* in 1912.

The darkening of zinc sulphide and of lithopone is of interest to the paint industry, as also are the factors influencing the color of some of the other sulphides.

The author has long been interested in the semi-permeability of colloidal membranes of copper ferrocyanide and so an extended and able discussion of this topic was to be expected.

The final section on Portland cement maintains the high level of quality of the rest of the book.

## CHEMICAL GARDENS

SOILLESS GROWTH OF PLANTS. By *Carleton Ellis* and *Miller W. Swaney*. Published by the Reinhold Publishing Corp., New York, N. Y., 1938. 155 pages. Price, $2.75.

Reviewed by *Chandler D. Ingersoll*

GROWING PLANTS without soil is a subject that has captured the imagination of the country. Here is a "first" book on the subject by two distinguished chemists.

Written as a popular discussion in simplified technical terms, it treats briefly of the chemistry of plant life, the three general methods developed to date for "dirtless farming", devices and simplified apparatus that have proved practical for amateur experimentation at home, the commercial aspects of the subject, plant hormones and special chemicals whose effects on plant growth have been investigated, plant parasites and the diagnosis of nutritional ailments, and finally a chapter containing eight nutritional formulas. The book is profusely illustrated. As a book on a new subject it is stimulating and interesting, and should send the average reader scurrying to try his own hand at growing plants this new way. On the other hand, this reviewer missed the thoroughness and care that has so typified the senior author's previous books. The lack of references alone are a sad handicap. Perhaps this will be corrected in future editions.

HOT-DIP GALVANIZING PRACTICE. By *W. H. Spowers, Jr.* Published by the Penton Publishing Co., Cleveland, Ohio. 194 pp. Price, $4.

Reviewed by *C. L. Mantell*

THIS volume covers the important field of zinc coating in a practical manner. It does not attempt to critically review the literature, a bibliography of which occupies 61 pages while the text covers 114.

It is to be regretted that the important zinc-iron alloy system is not included and its theoretical discussion omitted. Emphasis is placed on radiation-heating, cleaning, fused ceramic linings for galvanizing kettles, as well as materials of construction. In the chapter on the

control of oxidation and radiation there is mention of a proprietary material with no details of its composition. The information in the last four chapters on temperature control is elementary.

Perhaps the strongest section of the volume is the collection of plates showing kettle settings, wipers and generalized plant layouts.

CHEMICAL ENGINEERING CATALOG, 1938. 23d edition. Reinhold Publishing Co., New York, N. Y. 1,034 pages.

A NEW ADDITION to the catalog this year is a section comprising fifteen full-page charts and nomographs presenting various technical data. Some of these are new, while others have appeared before in the literature.

The size of the book is the same as last year and the usual sections on trade names, equipment and supplies, chemicals and raw materials, and technical books are retained.

MECHANICAL ENGINEERS' HANDBOOK—DESIGN AND SHOP PRACTICE. Edited by *Robert T. Kent.* Published by John Wiley & Sons, Inc., New York, N. Y., 1938. 1,378 pages. Price, $5.

THE PROVINCE of the chemical engineer is so broad that he is often called upon to perform duties normally thought of as being in one of the other engineering fields. Because of this it is important that he be equipped with a variety of reference tools.

The new design and shop practice volume of Kent's Handbook is one such tool that merits a place in even the smallest kit. Chemical engineers concerned with equipment design or maintenance will find it particularly valuable.

The division of the handbook into two volumes (the other volume, Power, published 1936, contains 1,226 pages) has meant a more thorough treatment of the earlier material and the inclusion of several new subjects.

## GOVERNMENT PUBLICATIONS

*Documents are available at prices indicated from superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.*

**Agricultural Statistics 1938.** Represents information formerly published in the statistical section of the Yearbook of Agriculture. Department of Agriculture; 55 cents (paper cover).

**Production of Explosives in the United States During 1937,** by W. W. Adams and V. E. Wrenn. Bureau of Mines, Report of Investigations 3414; mimeographed.

**Ball-Mill Grindability Indexes of Some American Coals,** by H. F. Yancey and M. R. Geer. Bureau of Mines, Report of Investigations 3409; mimeographed.

**Survey of Crude Oil in Storage, 1936–1937.** Bureau of Mines, Report of Investigations 3417; mimeographed.

**Natural-Gasoline Plants in the United States, January 1, 1938,** by G. R. Hopkins and E. M. Seeley. Bureau of Mines, Information Circular 7031; mimeographed.

**Petroleum Refineries, Including Cracking Plants, in the United States, January 1, 1938,** by G. R. Hopkins and E. W. Cochrane. Bureau of Mines, Information Circular 7034; mimeographed.

**United States Pulp and Paper Industry,** by James D. Studley. Bureau of Foreign & Domestic Commerce, Trade Promotion Series 182; 15 cents.

**A Manual for the Safe Handling of Inflammable and Combustible Liquids.** Bureau of Marine Inspection & Navigation, Educational Series No. 1. Available only from Bureau of Marine Inspection & Navigation, Washington, D. C.

**Commercial Standards.** Bureau of Standards Commercial Standards for: Liquid Hypochlorite Disinfectant, Deodorant, and Germicide, CS68-38; Pine Oil Disinfectant, CS69-38; Coal Tar Disinfectant (Emulsifying Type), CS70-38; Cresylic Disinfectants, CS71-38; Household Insecticide (Liquid Spray Type), CS72-38; 5 cents each.

**Package Sizes for Agricultural Insecticides and Fungicides.** Bureau of Standards, Simplified Practice Recommendation, R41-38; 5 cents.

**Federal Specifications.** New or revised specifications of the Federal Specifications Board on: Helmets and masks; (for) abrasive-cleaning, GGG-H-201; Gaskets, Rubber; molded, sheet, and strip, HH-G-156; Soap; soft, potash-linseed-oil, P-S-613, Amendment-1; Paper; Kraft, wrapping, waterproofed, UU-P-271, Amendment-1; 5 cents each.

**National Silicosis Conference.** The Division of Labor Standards has just issued Bulletin No. 21 in 4 parts, as follows: Part 1, Report on Medical Control; Part 2, Report on Engineering Control; Part 3, Report on Economic, Legal, and Insurance Phases; Part 4, Report on Regulatory and Administrative Phases; 15 cents each. These documents represent the final reports on the prevention of silicosis of the four committees appointed by the National Silicosis Conference.

**Earnings and Hours in the Explosives Industry, October 1937.** Bureau of Labor Statistics, Serial No. R756. Available from the Bureau of Labor Statistics, Washington, D. C.

**Grade of Ore,** by Andrew V. Corry and O. E. Kiessling. Works Progress Administration, National Research Project, Report No. E-6. Available from Works Progress Administration, 1734 New York Ave., N. W., Washington, D. C.

**T.V.A. Mineral Resources.** Mimeographed special reports available by purchase from Tennessee Valley Authority, Knoxville, Tenn., for cash (do not send stamps) as follows: (1) Clay Resources of T.V.A. Region, by Edwin C. Eckel et al. Geologic Bulletin No. 4; 50 cents; (2) Vermiculite and Bentonite of Tennessee Valley Region. Geologic Bulletin No. 5; 50 cents; (3) Manganese Resources of the Tennessee Valley Region, by H. S. Rankin, R. A. Laurence, F. A. W. Davis. Geologic Bulletin No. 7; 50 cents; (4) Tripoli Deposits of Western Tennessee and Mississippi. Geologic Bulletin No. 8; 50 cents; (5) Barite in The Tennessee Valley Region, by W. J. Penhallegon. Geologic Bulletin No. 9; 50 cents; (6) Iron, Chromite, and Nickel Resources of the Tennessee Valley Region, by E. C. Eckel, Charles E. Hunter, and Philip W. Mattocks. Geologic Bulletin No. 10; 50 cents.

**Coke and Byproducts Tables, 1937,** by H. L. Bennit and M. van Sicien. Bureau of Mines mimeographed document. Presents final statistics of production of byproduct and beehive coke in 1937.

**Wood Preservatives.** Forest Products Laboratory, Department of Agriculture; mimeographed. Available only from Forest Products Laboratory, Madison, Wis.

**Selected References on Wood Preservation.** Forest Products Division, Bureau of Foreign & Domestic Commerce; mimeographed.

**Third Semi-Annual Naval Stores Report.** Bureau of Chemistry & Soils, Department of Agriculture; mimeographed report on production, distribution, consumption and stocks of turpentine and rosin of the United States.

**Radium Protection.** National Bureau of Standards, Handbook H23; 10 cents.

**Economic Review of Foreign Countries, 1937.** Bureau of Foreign & Domestic Commerce, Economic Series No. 2; 25 cents.

**Synthetic Organic Chemicals,** by C. C. Concannon and J. N. Taylor. Bureau of Foreign & Domestic Commerce, Trade Promotion Series No. 189; 20 cents.

**Rubber: Some Facts on Its History, Production & Manufacture,** by P. W. Barker. Leather & Rubber Division, Bureau of Foreign & Domestic Commerce; 5 cents. Available only from Bureau of Foreign & Domestic Commerce, Washington, D. C.

**Active List of Permissible Explosives and Blasting Devices Approved Prior to June 30, 1938,** by J. E. Tiffany and Z. C. Gaugler. Bureau of Mines, Report of Investigation 3421; mimeographed.

**Fixation of Sulphur from Smelter Smoke.** Progress Report No. 26—Metallurgical Division, by A. H. Roberson and G. W. Marks. Bureau of Mines, Report of Investigations 3415; mimeographed.

**Synthetic Resins and Their Raw Materials.** Tariff Commission, Report No. 131 (Second Series); 25 cents.

**Dyes and Other Synthetic Organic Chemicals in the United States, 1937.** Tariff Commission, Report No. 132 (Second Series); 10 cents.

**Industrial Instruments and Changing Technology,** by George Perazich et al. Works Progress Administration, National Research Project, Report No. M-1. Available from Works Progress Administration, 1734 New York Ave., N. W., Washington, D. C.

**Beet Sugar,** by Raymond K. Adamson and Miriam E. West, Works Progress Administration, National Research Project, Report No. N-1. Available from Works Progress Administration.

**Statistics on Alcohol, Fiscal Year Ended June 30, 1938.** Bureau of Internal Revenue, Alcohol Tax Unit, Washington, D. C.; mimeographed.

**Production of Whiskey, Brandy, and Rum for 1937.** Federal Alcohol Administration Division, Treasury Department, Press Release No. 115; mimeographed statistical report.

**British and Canadian Trade Agreements.** Signed November 17, 1938. Available only from Department of State, Washington, D. C. This set consists of four parts, as follows: Text of Trade Agreement between the United States and the United Kingdom; The Trade Agreement with the United Kingdom, Supplement A; Text of New Trade Agreement between the United States and Canada; The New Trade Agreement with Canada, Supplement B.

**1938 Supplement to Survey of Current Business.** Survey of Current Business, Bureau of Foreign & Domestic Commerce; 40 cents.

# Readers' VIEWS and COMMENTS

## Idle Plants vs. Thriving Business

*To the Editor of Chem. & Met.:*

Sir:—In your public relations program for the chemical process industries (*Chem. & Met.*, October 1938, especially p. 554), you list some of the important services which an industry can render to its community. But you have failed to point out some of the ways in which a community can be of service to industry. Today more and more communities are beginning to realize that their own best interests are served by encouraging local enterprise. One needs only to contrast an idle, deserted plant with a thriving industry to understand why many cities are offering tax concessions and other means of attracting new business ventures.

One example of how civic cooperation benefited industry is to be seen in the recent rebirth of the once great sugar industry in the city of Yonkers, N. Y. A gigantic industrial enterprise, the Spreckels Sugar Refinery, was forced into receivership. It had provided employment for 1,200 or more people who lost their jobs when the plant shut down and remained closed for several years. In due course the Federal Court ordered a public sale of all the assets of the corporation and we were the highest bidders for the real and personal property. The city of Yonkers first objected to the consummation of the sale because it meant that a large amount of delinquent taxes on the idle plant would be virtually wiped out. The court thereupon rejected our original bid, but following a period of more than eighteen months' negotiation, we made a new offer to the court which the city approved. Ultimately, the sale was confirmed and the property conveyed to us.

Several months ago we sold approximately half of the property to Refined Syrups & Sugars, Inc., which is now completing alterations at a cost almost of $1,000,000. A new industry is rising out of the ruins of the old. The city is gaining a new employer who will provide jobs for hundreds of its citizens. Relief rolls will have been reduced as new money flows into local trade.

Ultimately, I am confident that the entire site of the sugar refinery, which during its long period of idleness had taken on an appearance of desolation and ruin, will be occupied with new industries. Upon its several acres will grow a new industrial center and this is possible only because the city officials, especially Mayor Joseph F. Loehr, had the vision and foresight to cooperate in a constructive effort to rebuild an industrial community.

This example from our own experience is cited merely to call attention to the type of opportunities that are gradually opening up in all parts of the country. There never has been a time when the initial investment necessary to produce profits has been so low. Plant equipment, industrial sites, machinery and supplies are available at unheard-of savings. In the words of your November editorial, truly, now is the time to go ahead!

A. M. KAHN
President, Consolidated Products Co.
New York, N. Y.

### LEFT HAND ARTICLES

*To the Editor of Chem. & Met.:*

Sir:—As a reader of *Chem. & Met.* for several years, I have noticed that it is your policy to begin most articles on the left-hand page of the magazine.

Would it be possible to effect a change so that the articles begin on the right-hand page?

I am certain that there are many readers besides myself who clip and file the most important articles, and who would appreciate the change for greater ease in filing each article separately.

WILLIAM S. REVEAL
West Allis, Wis.

Psychologists and others who have studied reading habits insist that an article should start on the left-hand page for maximum eye appeal. In other words, such an arrangement offers the best opportunity to bring to the reader's attention the heading of the article, the author, and the principal illustrations. That is why this technique is so largely applied in the so-called popular magazines.

The advantage of a right-hand start to anyone who clips and files important articles is quite apparent. *Chem. & Met.* tries to oblige on all data sheets and articles of the sort which the average reader is most likely to want to remove from the magazine.—*Editor.*

### PAIN IN THE WRENCH

*To the Editor of Chem. & Met.:*

Sir:—In looking over some old copies of your magazine I find some requests for a universal wrench for opening drums.

May I suggest that this puts the shaft behind the buggy?

The different wrench requirements of drums made for or by different companies has always been a pain in the wrench to anyone in the paint or allied industries. Why could not the drum manufacturers get together on a type of bung which is easily opened by a single common ordinary wrench?

FOSTER H. POLAND
Jamestown Wood Finish Co.
Jamestown, N. Y.

### DATA SHEET CORRECTIONS

THERE WERE two important omissions from the tabulated lists of materials of construction published in the November issue of *Chem. & Met.* Our attention has been called to the fact that the American Smelting & Refining Co., New York, N. Y., was not included among the producers of chemical lead and all grades of antimonial lead listed on pages 634-35. The Republic Steel Corp., Cleveland, Ohio, should have been listed on pages 639-40 among the manufacturers of low-alloyed steels. Toncan Iron is a refined open hearth iron, with which is alloyed not less than 0.40 per cent copper and 0.05 per cent molybdenum. It has the following properties: specific gravity, 7.88; melting point, 2,775 deg. F.; thermal conductivity, 0.18 cal./cm²./sec./deg.C.; linear coeff. of thermal expansion, 0.00000674 in./in./deg.F., 32-212 deg.F.; tensile strength, 48,000-58,000 lb./sq.in.; elongation in 2 in., 32-40 per cent; reduction of area, 56-75 per cent; Rockwell hardness, B scale, annealed, 38-46, cold-rolled, 46-60.—*Editor.*

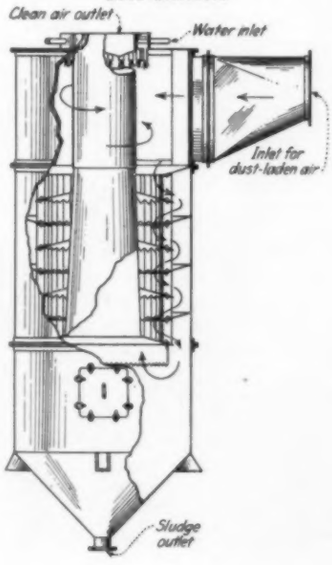
# Machinery, Materials and Products

## Wet Dust Collector

For the collection of dusts of all kinds and the suppression of fumes, the Sturtevant Mill Co., Park and Clayton Sts., Dorchester (Boston), Mass., has introduced the Hydro-Clone dust collection system, which comprises a water-wetted collector using the cyclone principle, in combination with a sludge dewatering tank to permit reuse of the water, and an exhaust fan on the clean-air side of the system. When it is desired to recover the coarser dust, a dry cyclone employing a new and efficient design, precedes the wet collector.

Construction of the Hydro-Clone collector is evident from the accompanying drawing which shows that the dust-laden air enters the upper chamber tangentially, and there receives an initial wetting. Spiralling downward through the collector, the water and air pass simultaneously through each of many bladed sections where the water is broken up into a fine spray which washes and scrubs the entire surface. The spiral path of the air and water ends finally in the bottom of the collector where the dust is deposited as a sludge and the clean air is removed through an axial tube connected to the fan suction.

**Cutaway view of Hydro-Clone dust collector**




Both entrainment of water in the exit air, and dead zones in the collector, are said to be completely eliminated.

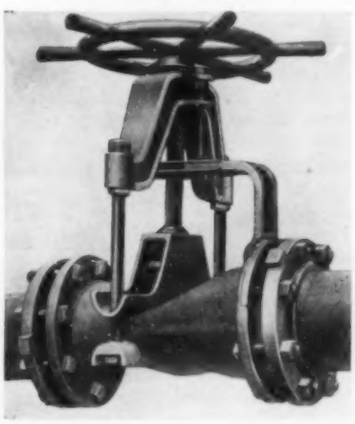
It is stated that dusts can be handled even at temperatures as high as 1,800 deg. F., while the collector can also be used as an effective gas washer, for example, in the cleaning of blast furnace gas. In connection with grinding and pulverizing plants, the combination of wet and dry collector serves to collect the bulk of the dust in dry form and to suppress the nuisance of fine dust. The company is prepared to supply a special abrasion-resisting pump for circulating water through the collector, as well as an exhaust fan particularly adapted to this service. It should be pointed out that the fan and pump are the only moving parts in the system.

## Pinch Valve

Mine & Smelter Supply Co., Denver, Colo., has introduced the Massco-Grigsby pinch valve, a new design consisting of a special rubber sleeve and a clamp mechanism which pinches the sleeve to regulate or stop the flow of liquid through the valve. The body of the valve, constructed of a special grade of rubber, is said to provide enough flexibility to compensate for slight misalignment in the pipe lines and to eliminate danger of breaking or freezing. The rubber sleeve is reinforced with heavy fabric to withstand a pressure up to 150 lb. To prevent cracking of the sleeve when the valve is closed, two recesses have been molded into the inside walls, diametrically opposite each other.

Metal parts are replaceable without interfering with the regular flow through the line. The rubber sleeve can be replaced without renewing the metal parts. As the valve has no bonnet or packing gland, infrequent attention is said to be needed. Regular sizes of the new valve are 4, 6 and 8 in.

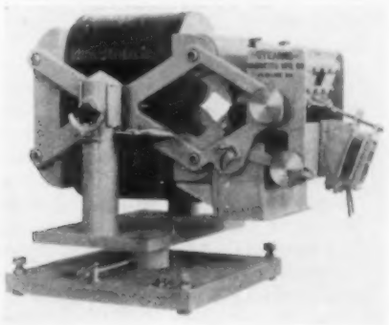
**New rubber pinch valve**



## New Magnetic Separator

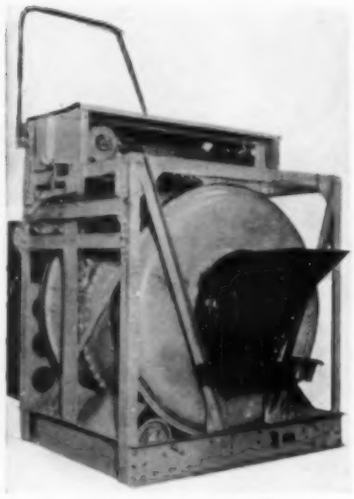
Simplicity of design and operating principle and the elimination of moving elements such as conveyor belts and rolls are features of the new Type KS Para-Magnetic separator recently announced by the Stearns Magnetic Mfg. Co., Milwaukee, Wis. The magnetic field is designed for maximum concentration and the required number of fields can usually be incorporated in this type of separator, according to the manufacturer, to provide complete separation is one operation. The magnetic fields are arranged for and adjusted to varying degrees of magnetic intensity. The rate of flow and type of separation are made adjustable for maximum capacity and highest possible separation in a single treatment, or by a single passage of material through the separator. Standard windings for this type include voltage up to 250 and provision is afforded for accurate readings by ammeters in circuit with the windings. In this way each magnetic field can be regulated to a definite strength and power to facilitate duplication of results when changing from one material to another.

**Type KS Para-Magnetic separator**



## Glass Batch Mixers

FOR RAPID and thorough mixing of glass batch ingredients, the Chain Belt Co., Milwaukee, Wis., has introduced a new Rex glass batch mixer, suitable for either wet or dry batches. The machine employs a rotating mixing drum of high carbon steel, lined with alloy steel renewable liners. Mixing buckets are also made of alloy steel. Dust seals are provided for both the charging and discharging ends, thus confining dust to the drum while mixing, charging or discharging. In one installation, a mixing time of 3 min. was obtained, according to the manufacturer, and satisfactory mixes were obtained in even less time, although this was not generally practical because of limitations of related operations. For wet mixing, a water tank is provided by the manufacturer.



New Rex glass batch mixer

## Thickener-Clarifier

A NEW DESIGN of multiple-cone thickener-clarifier which employs no moving parts has recently been perfected by the firm of T. An. Tesch A/B, Stockholm, Sweden. The new apparatus consists of two or more cone-shaped vessels placed coaxially, one within the other, in such a manner that between two adjacent cones a space is formed for the slurry to be treated. The lower part of the unit receives the pulp mixture which is introduced in such a manner that the liquid is given a rotating motion. The movement of the liquid has the greatest velocity at the point where it enters the section, the speed decreasing as it rises helically around the increasing diameter. During this motion, solids are stated to separate from the liquid and this separation is caused not only by sedimentation proper, but also to some extent by centrifugal action.

The clarified liquor follows the upper wall of the section in its helical motion and overflows in a peripheral gutter at the top. Meanwhile the descending sludge current slides to the bottom of the section and is continuously discharged by means of a sludge pump.

Sections may be arranged in parallel or in series to give flexibility of operation. By the addition of more cones, the capacity can readily be increased. Any section may be shut off without disturbing operation and each section is readily accessible.

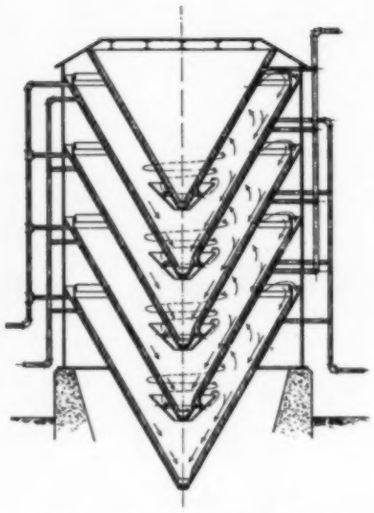
## Tank Car Valve

A NEW TYPE of tank car outlet valve recently introduced by the George Valve Co. of Saegerstown, Pa., is said to overcome all the major causes of valve failure that have been encountered in earlier valves for this purpose. Furthermore, it is stated to incorporate a number of other improvements. Corrosion of the valve parts has been eliminated through the use of virgin bronze which eliminates galvanic action. The collection of scale or other foreign matter between the valve face and the seat is said to be prevented, first, by sealing the face of the valve while it is open and second, by providing a wiping action which cleans the seat of scale every time the valve is closed. Specially formed neoprene parts accomplish these two actions. These parts are essentially rings surrounding the face of the valve disk. They are shown at *A* and *B* in the accompanying cross-sectional view. In the open position, the rings move toward each other so as to shield the valve face. Closing accomplishes the wiping action referred to above.

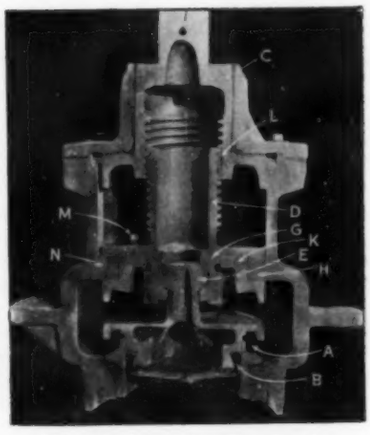
The valve is opened through part *C* which is rotated from the top of the tank car. Part *D* is kept from turning by friction. Ball *E*, held in housing *G*, is not restrained except by the housing. The assembly is kept from rotating by friction of *G* and *K* on the ring *H*. *H* slides up and down inside the valve housing. The friction can be regulated by screw *M*. This type of arrangement makes it possible to permit slip at a certain degree of valve tightness so as to prevent possible injury to the seat.

## New Gage Glass

AN IMPROVED TYPE of Pyrex gage glass has recently been announced by the Corning Glass Works, Corning, N. Y. Known as Pyrex Broad Red Line gage glass, the new product differs from previous types in that the red stripe is transparent and is so proportioned to the diameter of the tube as to make the entire tube appear red below the water line. The stripe is fused permanently to the wall of the tube. When the tube is supplied with a small slotted illuminator placed directly behind it, brilliant visibility is said to be attained without distracting glare. The new glass is made in lengths to 24 in. and in diameters from ½ to 1 in. inclusive.



Cross-section of new thickener-clarifier




Cross-section of tank car valve

## Plastics Refractories

PLASTIC and castable refactory materials for the production of monolithic linings for furnaces, kilns and stoker settings and for similar high temperature applications have been announced by the United States Stoneware Co., Akron, Ohio. Vitriram is a plastic refractory ramming mix suitable for applications at temperatures not exceeding 2,900 deg. F. For higher temperatures, Super-Vitriram is available. Vitricast is a hydraulic-setting, castable refractory for temperatures up to 2,400 deg. F. The latter material can be poured into forms, cast in molds or sprayed with a cement gun. According to the manufacturer, these materials produce harder and stronger refractory mixes than average materials of their type.

## Supplied-Air Respirators

BUREAU OF MINES approval has recently been accorded to a new line of supplied-air respirators (hose masks) developed by the Acme Protection Equipment Co., 3616 Liberty Ave., Pittsburgh, Pa. The

new equipment features the full-vision mask described on page 152 of our March, 1938, issue. Instead, however, of being supplied with a canister for protection against industrial vapors, gases and smokes, the new equipment, designed for penetrating into dangerous gaseous or oxygen-deficient places, includes a blower for air supply, oilproof connecting hose, safety belt harness and the full-visioned face piece. The equipment includes a fiber carrying trunk and is built in one- and two-man models.

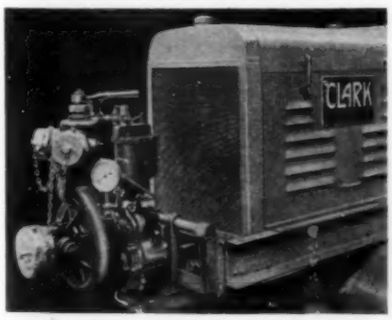
This company has also announced the award of U. S. Bureau of Mines approval to the earlier announced canister type masks.

## Metal Spray Gun

TYPE E is the designation of the new Metco metallizing gun recently developed by the Metallizing Engineering Co., 44 Whitehall St., New York, N. Y. The new gun is stated to be faster, to give more reliable and economical results, and improved spraying characteristics as compared with earlier equipment. Extremely fine coatings are said to be obtained at production speeds. Improved nozzle and jet construction are claimed to reduce gas consumption and result in the deposit of a maximum amount of the metal sprayed. Extremely light weight is attained through building the case of heat-treated Dowmetal magnesium alloy, giving a gun weighing only 3¾ lb. A multiple-jet turbine to drive the feed makes instantly available two complete speed ranges, covering all speeds necessary for commercial metals. Acetylene from either tanks or generators may be used, at pressures up to 15 lb. All parts are stated to be completely interchangeable and may be assembled without adjustment.

New light weight metal spray gun

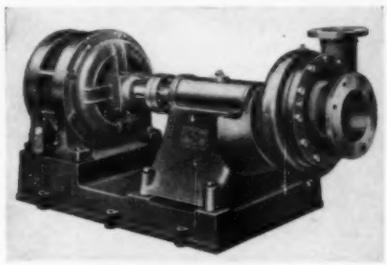
Tractor-mounted fire pump



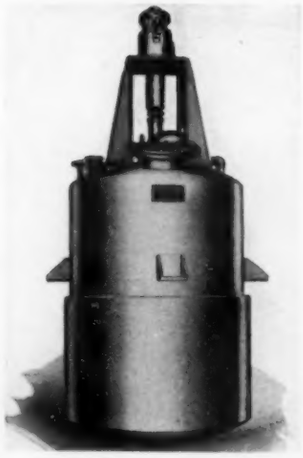

## Tractor Fire Pump

AUXILIARY FIRE PROTECTION is the function of a new special duty fire pump which may be factory installed as a part of the Clarktor-6 industrial tractor, manufactured by the Clark Tructractor Co., Battle Creek, Mich. The pump is of the centrifugal type and meets test requirements of the National Board of Fire Underwriters. It has been designed to handle any kind of water, regardless of dirt, and hence may be used when the source of supply is a pond or creek. When taking supply through a 4-in. suction opening from a 30-lb. hydrant, the pump will deliver 400 g.p.m. at 120 lb. pressure with the motor running at 1,800 r.p.m., its normal controlled speed. Pump capacity may be increased by adjusting the governor of the 46-hp. six-cylinder tractor engine. The manufacturer points out that this equipment is also useful for flushing floors, as a plant housekeeping adjunct.

Type HBD Vortex pump



Kettle for textile oil emulsions



## Single-Stage Pump

SIZES ranging from 1½ to 18 in. discharge, with capacities from 10 gal. per min. to 15,000, and heads up to 300 ft. in the smaller sizes, are available in a new line of single-stage, side-suction centrifugal pumps for general industrial use recently announced under the designation of Type HBD by the Lawrence Pump & Engine Co., Box 70, Lawrence, Mass. Pump casings are of the single volute type with a removable suction head. This may be removed without disturbing the discharge pipe or pump alignment and is designed to eliminate air pockets. The impeller is of the inclosed type, cast in one piece. Since the pump casing and bracket are separate parts, casings may be furnished inexpensively in special alloys for handling corrosive liquids. Impellers of cast iron, bronze or special alloys, when specified, are available.

The shaft is carried on two heavy duty double-row ball bearings, lubricated by an oil reservoir and entirely external to the pump. The bearing nearer the pump carries radial load only and is self-aligning, while the outer bearing carries both thrust and radial load.

## Oil Emulsion Kettle

PATTERSON FOUNDRY & MACHINE CO., East Liverpool, Ohio, has developed a line of kettles built of stainless steel and available in a variety of sizes for the production of textile oil emulsions. These kettles are equipped with motor drive and an improved type of stirring mechanism. They are furnished either with or without vent condensers. All internal parts are ground and polished to insure absolute cleanliness in operation. The kettle illustrated is built for 50 lb. internal working pressure and 65 lb. jacket pressure.

## Diffusion Vacuum Pumps

ORIGINALLY DEVELOPED by Kenneth C. D. Hickman and associates in the research laboratories of the Eastman Kodak Co. of Rochester, N. Y., for the solution of problems in photographic film drying during manufacture, a new line of diffusion pumps for the production of extremely high vacuum has recently been put on the market by Distillation Products, Inc., Rochester, N. Y., a company recently organized jointly by the Eastman Kodak Co. and General Mills, Inc. The new pump is said to approach more closely to a perfect vacuum than has been obtainable commercially by equipment heretofore available. In place of a rotating impeller, the diffusion pump uses a beam of oil vapor. Molecules of the vapor bombard the molecules of the gas being exhausted and carry them to the inlet of a mechanical pump which completes the work of ejection. In the past difficulty has been

experienced because of impurities in the oil. The new pumps eliminate this difficulty by purifying their own oil by a simple fractionating principle. It is stated that the longer they operate at a stretch, the purer their oil becomes and the better vacuum they produce. Impurities are split off and deposited outside the main oil stream.

Vacuum produced by the new pumps is stated to approach closely to the vapor pressure exerted by the pumping oil employed.

## Noiseless Check Valve

A NEW PRINCIPLE of construction is claimed for a new air check valve recently introduced by C. A. Norgren & Co., Denver, Colo. As appears from the cross-sectional view, the moving portion of the valve is so constructed as to be held in suspension by the suction created above the valve stem by the flow of air itself past the siphon hole in the valve body. When the compressor is operating under normal conditions, the check remains open and the air passes freely and quietly into the receiver. When the compressor stops, the vacuum above the stem is broken and the valve returned to its seat. Thus it is claimed that valve hammer, common to ordinary valves, is completely eliminated.

## Ratio Meter

A NOVEL CONSTRUCTION in a direct-reading ratio meter for the measurement of air and gas has recently been developed by the Askania Regulator Co., 1603 South Michigan Ave., Chicago, Ill. The meter consists of two flow metering elements, one for air and one for gas. The indicating pointers are arranged to cross in the chart area so that the intersection of the pointers indicates the relation between the two flows. As long as the pointers cross on the vertical center line of the scale, maintenance of a neutral flame is indicated. Crossing of the pointers to one side of the center-line indicates excess air, and to the other side, air deficiency.

## Acid Carboy Lifter

A HAND-POWERED LIFTER for acid carboys, equipped with lifting arms which descend all the way to the floor, has recently been designed by the Service Caster & Truck Co., of Albion, Mich., and Somerville, Mass. With the lifting arms fully lowered, the carboy is securely fastened in a cradle and then a few strokes of a handle raises the arms to the desired height. A small hand crank rotates the carboy into a position for dumping. Pulling a handle connected to a hydraulic unit lowers the carboy gently to the floor level. The unit is mounted on wheels for ready movement but floor locks on the rear wheels are provided for stability.

## Clarifying Filter

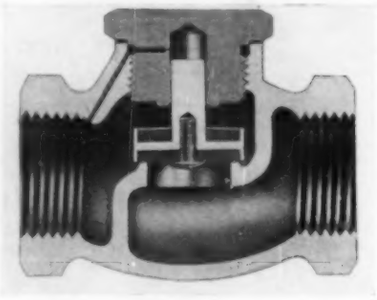
UNDER THE NAME of Tank Furka, American Seitz Filter Corp., 480 Lexington Ave., New York, N. Y., has introduced a new cylindrical filter of the alluvial or pressure-leaf type, which combines in one unit the filter vessel, a mixing tank, a pump and a portable stand. The cylindrical filtering unit is stated to provide large filter surface in a compact container. Finely divided filtering material is suspended in a small part of the unfiltered liquid and is then floated on to the fine screening of the cylindrical frame. The materials used are different grades of asbestos, filter aid or charcoal. Frequently a thin layer of asbestos is floated on the frames, followed by filter aid or charcoal. When cleaning, there is only the cylindrical screen to remove instead of several filtering elements as in alluvial filters of the usual type.

The new filter is stated to give exceptionally high removal of turbidity, regardless of the character or viscosity of the filtered solution. Various sizes are obtainable with areas of filter surface ranging from 11 to 45 sq. ft. Models are also supplied without accessories.

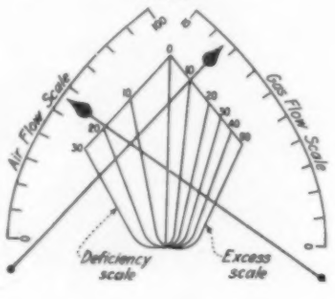
## Sacking Scale

MODEL 2226-B is the designation of a new design of sacking scale recently announced by the Exact Weight Scale Co., Columbus, Ohio. The new model is equipped with the patented Duckbill type bag-holder, designed for stapled gusset paper bags. However, this holder will accommodate other types including paper-lined cotton and multi-wall paper bags. Similar to other sacking scales made by this company, the scale is installed directly under the hopper valve. The indicator is inclosed in an adjustable housing which can be set at any position to suit the operator's convenience. The indicator is of the under-and-over type, permitting the operator to cut the feed to a dribble as correct weight is approached.

Norgren noiseless check valve



Pointers and scale of new ratio meter




## Mechanical Drive Turbine

A NEW LINE of single-stage turbines for mechanical drive, designated as Type CY, and covering a size range extending upward from that of the company's Type AY and BY turbines has been announced by the Elliott Co., Jeannette, Pa. The design is stated to provide for both lateral and axial expansion and to eliminate misalignment under wide temperature variations. A horizontally split casing is employed, with both steam and exhaust connections in the lower half of the casing. An especially sensitive normal-speed governor is used which is provided with a double-seated corrosion-resistant valve. An emergency over-speed governor actuates its own valve. These machines are built with either two or three-bucket wheels, the revolving and stationary buckets both being made of stainless steel. The machines are designed for steam pressures up to 600 lb. gage and temperatures to 750 deg. F.

Hand operated carboy lifter

Seitz Tank Furka filter

# MANUFACTURERS' LATEST PUBLICATIONS

**Alloys.** Babcock & Wilcox Tube Co., Beaver Falls, Pa.—Letter-size card, giving creep stress data on the various Croloys and other materials supplied in tubular form by this company. Data recommended for use in design.

**Alloys.** Haynes Stellite Co., Kokomo, Ind.—8-page price list on Hastelloy alloys with information on sizes, weights, limits and prices of Hastelloy castings, hot rolled sheets, plates and bar stock.

**Alloys.** Michiana Products Corp., Michigan City, Ind.—Booklet 108—16 pages giving essential data on heat and corrosion-resistant alloy castings produced by this company, with information on production of centrifugal castings.

**Bearings.** New Departure Division, General Motors Corp., Bristol, Conn.—Bulletin R 27—1939 edition of this company's ball bearing interchangeability tables.

**Burners.** Hauck Mfg. Co., 124 Tenth St., Brooklyn, N. Y.—Catalogs 802, 3, 804—Respectively 6-, 4- and 2-page catalogs covering this company's low pressure air-gas induction mixers; high pressure gas inspirators; and gas burner nozzles.

**Carbon.** Columbian Carbon Co., 41 East 42d St., New York City—193-page book on this company's colloidal carbons, a limited edition being distributed to industries now using or contemplating use of colloidal carbons. Gives information on history, character and properties of colloidal carbon and its use in various industries. Gives information on manufacture, research and tests.

**Castings.** American Manganese Steel Div., American Brake Shoe & Foundry Co., Chicago Heights, Ill.—24 pages detailing information on this company's heat- and corrosion-resisting alloys and the castings produced from them. Also covers the company's research and production facilities.

**Chemicals.** Carbide and Carbon Chemicals Corp., 30 East 42d St., New York City—Chemical Group Folder No. 10—Describes and presents physical and chemical properties of 14 commercial amines. Also folder reprinting an article commenting on morpholine in wax polishes.

**Chemicals.** Shell Chemical Co., San Francisco, Calif.—Book entitled "Methyl Ethyl Ketone, Its Uses and Data on its Properties," carrying complete data on this solvent and illustrated with tables, charts and graphs. Compiled by staff of Shell Development Co.

**Control.** The Luxtrol Co., 54 West 21st St., New York City—10-page booklet on the phototube and its use in a variety of control problems as in weight measurement and grading control. Numerous typical applications are listed.

**Controllers.** Fisher Governor Co., Marshalltown, Ia.—Catalog 35—12-section general catalog, describing in detail this company's pump governors, regulators, liquid level controllers, valves, traps and strainers. Describes and illustrates 183 different automatic controls and steam specialties, gives list prices and several useful alignment capacity charts.

**Crushers.** Straub Mfg. Co., 507 Chestnut St., Oakland, Calif.—8 pages describing the Kue-Ken balanced crusher, a type of jaw crusher which is said to operate on a new and improved principle.

**Equipment.** Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletin W-200-B4—4 pages on this company's hydraulic tube washer for surface condensers.

**Instruments.** American Meter Co., Erie, Pa., and Reliance Regulator Corp., Alhambra, Calif.—Bulletin to assist users in specifying meters and regulators for measurement and control of liquefied petroleum gases.

**Instruments.** American Meter Co., Metric Metal Works, Erie Pa.—Bulletin E-22—Completely describes this company's recently developed air-actuated remote controllers and recorders for flow and pressure.

**Instruments.** The Bristol Co., Waterbury, Conn.—Bulletin 521—Describes this company's control instruments for the protection of gas-fired ovens and furnaces, with information on practical applications. Also Bulletin 517, describing a variety of air switches for manual and remote control of electrically and air-operated valves.

**Instruments.** R. Y. Ferner Co., 131 State St., Boston, Mass.—4-page folder describing the Steiner viscosimeter marketed in the United States by this company.

**Instruments.** Fischer & Porter Co., 110 West Penn St., Philadelphia, Pa.—Bulletin 103—A 28-page illustrated bulletin describing this company's complete line of rotameters. Several new and improved designs at lower prices are featured. Booklet contains numerous diagrams, tables and other engineering data.

**Materials Handling.** C. O. Bartlett & Snow Co., Cleveland, Ohio—Bulletin 83—48 pages on this company's coal-handling equipment for boiler plant with description of equipment and information on equipment layout.

**Materials Handling.** Chain Belt Co., Milwaukee, Wis.—Catalog 334—64 pages on screw conveyors and parts; also bucket elevators. Includes useful screw conveyor selection tables.

**Materials Handling.** The Lamson Co., Syracuse, N. Y.—36-page catalog on this company's roller gravity conveyors with information on design, supports, switches and detailed specifications covering individual types.

**Meters.** American District Steam Co., North Tonawanda, N. Y.—Bulletin 35-80A—12 pages on accurate metering of steam in the form of condensate with this company's condensation meter.

**Packings.** Alexander Brothers, 406 North 3d St., Philadelphia, Pa.—Catalog A-49—32-page booklet on this company's leather packings for pumps, plungers, hydraulic presses and other purposes.

**Ply-Metal.** Lukens Steel Co., Coatesville, Pa.—Bulletin T-4—15 pages completely descriptive of methods for the fabrication of this company's nickel-clad steel.

**Power Transmission.** Philadelphia Gear Works, G St. and Erie Ave., Philadelphia, Pa.—Bulletin MR38—40 pages describing in detail and with detailed engineering data this company's Motoreducers; also flexible and resilient couplings.

**Pumps.** DeLaval Steam Turbine Co., Trenton, N. J.—Catalog B-5—36-page illustrated catalog completely covering distinctive features and construction of this company's single-suction multi-stage motor- and turbine-driven centrifugal pumps.

**Pumps.** Worthington Pump & Machinery Corp., Harrison, N. J.—Publications as follows: W-318-B1B, Balanced multi-stage volute centrifugal pumps; W-423-B5, Vertical, triplex, single-acting power pumps; W-475-M2, 500-5,000 g.p.m. rotary pumps for pressures to 150 lb.

**Refractories.** Ironton Fire Brick Co., Ironton, Ohio—4-page leaflet describing this company's Alset, a high temperature mortar for a variety of uses.

**Refractories.** Quigley Co., 56 West 45th St., New York City—Catalog HG-501—20 pages on this company's Hytempite high temperature cement with detailed information on its applications. Also briefly describes this company's other high temperature refractory and insulating refractory products.

**Resins.** The Neville Co., Neville Island, Pittsburgh, Pa.—64 pages on this company's resins, including coumarone-indene, modified coumarone-indene and cycloparaffin resins, with information on uses, properties, grades, testing methods and useful data.

**Screens.** Allis-Chalmers Mfg. Co., Milwaukee, Wis. — Bulletin 1474-B — 8 pages describing in considerable detail this company's mechanically vibrated screens.

**Steam Generators.** Griscom-Russell Co., 285 Madison Ave., New York City—Bulletin 520—8 pages on this company's Bentube steam generators for the recovery of heat in hot gas oil or cracking coil tar.

**Steel.** Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.—Condensed steel stock list and data book, explaining change in steel classifications and extras with general data tables, condensed summary of products available for immediate shipment and article describing this company's services.

**Valves.** Edward Valve & Mfg. Co., East Chicago, Ind.—8-page bulletin briefly discussing this company's laboratory methods used in research and production testing of valve materials.

**Water Treatment.** International Filter Co., 59 East Van Buren St., Chicago, Ill.—Bulletin 1700—8 pages on the use of Hydrodarco activated carbon for removing tastes and odors from water.

**Water Treatment.** The Permutit Co., 330 West 42d St., New York City—Publications as follows: Bulletin 2111, 4 pages on this company's rate of flow indicator; 2118, 8 pages on Permutit Zeo-Karb, a new zeolite material having new and important properties; 2142, 4 pages on this company's degasifier; 2153, 6 pages on multiport valve control; 2154, 6 pages on operating cabinets and tables for water treatment plants.

**Water Treatment.** Wm. B. Scaife & Sons Co., Oakmont, Pa.—Bulletin 299—8 pages describing this company's Ferec iron removal filters for eliminating iron minerals from water by catalytic filtration.

**Welding.** Air Reduction Sales Co., Lincoln Bldg., New York City—Catalogs 22 and 21—Respectively a 32-page condensed catalog and a 64-page complete catalog, covering welding and cutting torches and equipment, accessories, rods and other supplies. Catalog 22 covers equipment required by smaller, and Catalog 21 covers equipment required by larger users of oxy-acetylene and electric arc equipment.

**Welding.** Lincoln Electric Co., Cleveland, Ohio—Bulletin 401-A—36 pages on procedures for producing all types of welds in mild steel and all other metals used to any considerable extent industrially, with further information on application of surfacing metals. Covers also electrodes and arc welding accessories. Also Bulletin 412-A, 20 pages, describing a new model of this company's shield-arc welder with self-indicating dual continuous control, including information on new arc welding technique achieved with this welder.

**Wire Rope.** Gilmore Wire Rope Div., Jones & Laughlin Steel Corp., Muncy, Pa.—12-page brochure announcing completion of Gilmore Division's new plant at Muncy, with illustrations covering various phases of manufacture.

# Many New Devices at Power Show

EDITORIAL STAFF

ONCE AGAIN a trio of foot weary editors returns from the Power Show, this the thirteenth of the series that is held biennially in New York, at the Grand Central Palace, during the week in which the American Society of Mechanical Engineers holds its annual meeting. Once again many new developments have been uncovered, some of course of interest principally to mechanical engineers, but many equally interesting to chemical engineers and others associated with the process industries. As in the past our present aim is to describe briefly the developments of the latter type which have been commercialized in the period since the last Power Show.

Probably the greatest number of new devices in a given group were to be found among the power transmission equipment, the valves, the pipe and fitting, and the instruments and control equipment. In the field of power transmission, a tremendous development has taken place in variable speed transmissions. For example, a new and extremely simple variable speed transmission was shown by the Ideal Commutator Dresser Co., Sycamore, Ill. The unit consists of a pair of variable pitch V-belt sheaves mounted on the same shaft and supported on a bearing which is movable by means of a speed control handle along the line of the belts. Driving machine and driven machine are connected with separate belts to the two sheaves. The shaft is capable of sliding through the bearing, and in so doing increases the pitch of one sheave while it decreases the pitch of the second by a corresponding amount. Thus, when the unit is moved from one position to another between the driving and driven machines, tension in the two belts remains constant, but the pitches are altered so as to change the speed ratio as desired.

Two recent hydraulic transmission developments were exhibited by the American Blower Corp., Detroit, Mich. One is the so-called traction type coupling, a simplification of this company's standard variable-hydraulic transmission which provides no means for varying the driven speed, and so is used only as a starting and overload coupling. A new variable speed coupling, the scoop-controlled type, is another simplification of the basic type, suitable for loads to 10 hp. Having passed through the coupling and transmitted power from the driving to the driven side, the oil flows into a cylindrical casing which rotates with the coupling. All or part of the oil may be returned continuously by means of an adjustable scoop. With little oil returned, the coupling transmits reduced speed.

A new variable speed transmission said to combine several well known elements that have been used in earlier designs was shown by B. F. Perkins & Son, Holyoke, Mass. The drive combines a planetary transmission with a variable-sheave V-belt transmission in such a way that a small fraction of the total power transmitted is handled by the belt, while the greater part is transmitted positively through the planetary device. The driving side drives both the V-belt drive sheave and the sun gear. The driven V-belt sheave drives the ring gear and so controls the speed of the carrier for the planet gears which is connected to the controlled speed output. Speed adjustment is accomplished by varying the V-belt sheave ratio.

Allis Chalmers Mfg. Co., Milwaukee, Wis., demonstrated its recently developed Vari-Pitch speed changer, a variable speed transmission employing a number of V-belts operating on variable pitch sheaves, as the speed altering and power transmitting agency. Units are now available in sizes of greater capacity than any other type of variable speed transmission.

Morse Chain Co., Ithaca, N. Y., showed its recently perfected positive variable speed control. In this device motion is transmitted from the drive shaft through a cam and linkages to three free-wheeling clutches which pass the motion on to the output shaft. Speed variation is accomplished over a wide range by rotating the linkage fulcrums so as to alter the duration of contact with the cam.

The Falk Corp., Milwaukee, showed a new controlled torque coupling, combining in one unit one of this company's regulation Steelflex couplings and a spring-loaded frictional power transmitting member. The use of shear pins is eliminated and the driven machine may be started immediately when the obstruction which caused the overload is cleared. The friction clutch member is adjustable to transmit any torque from zero to the capacity of the coupling.

Thomas Prosser & Son, New York City, displayed the Radicon air-cooled worm gear reducer, recently brought to this country from England where it is made by David Brown & Sons. A fan built into the housing air-cools the unit, permitting an increase of over 100 per cent in horsepower transmitted as compared with an ordinary gear reducer, according to the maker.

Several other power transmission developments were noted. The Triple Seal for bearing housings was shown by SKF Industries, Inc., Philadelphia. This consists merely of circumferential ribs on the shaft mated with notches in the housing and constructed with minimum clearance. The Twin Disc Clutch Co., Racine, Wis., has replaced the sliding engagement keys in its multiple disk clutches with roller engagers to increase life and ease of operation. Boston Gear Works, Inc., North Quincy, Mass., displayed a 5-hp. bevel gear right-angle drive and reducer in 2 to 1 and 3 to 1 ratios.

Valve manufacturers showed evidence of much development activity in the period since the last Power Show. Several improved 1,500 lb. valves were shown, with a fairly even division between the manufacturers who had retained the bolted bonnet, and those using a welded-on bonnet. The welded bonnet means a large reduction in valve weight, perhaps as much as 50 per cent, but introduces problems in maintenance. Another trend that has become general in high pressure steam valves is the use of Stellited seats and closure members. Valves for 2,500 lb. pressure were shown by two manufacturers, the William Powell Co., of Cincinnati, and the Chapman Valve Mfg. Co., Indian Orchard, Mass. The first of these concerns exhibited two angle valves for this pressure, both of special construction specified by the large chemical works for which they were built. Among the large valves was a toggle operated valve for 900 lb. pressure built by Reading-Pratt & Cady Div. of American Chain & Cable Co., Bridgeport, Conn,. which offered the advantages of more even pressure on the stem in closing, together with the possibility of using a smaller operating motor by reason of the mechanical advantage of the toggle arrangement.

In the display of the Ohio Injector Co., Wadsworth, Ohio, was a new line of U-bolt valves of cast iron featuring brass seats cast in and rolled into place. A special drain bonnet is used. The design, available in sizes to 4 in., is also made in all-iron construction. This company showed a 500-Brinell plug type globe valve for 200 lb. working pressure.

The McAlear Mfg. Co., Chicago, displayed its semi-balanced double diaphragm valve for handling liquids containing solid particles. The diaphragms are made of an impregnated laminated fabric material which is said to resist both acids and alkalis.

The Clyde valve, a new development shown by R. W. Cramer & Co., New York, is a single-flange angle valve with double disks and seats and may be adapted for use as a blow-off, strainer, check or globe valve. An unique feature is that the valve seat may be ground while the valve is in operation.

Two new products in the booth of the Henry Vogt Machine Co., Louisville, Ky., included a 150-lb. A.S.A. flanged gate valve made of forged steel (made in the 300-lb. size), and a new line of drop-forged meter type valves whose outstanding feature is a union bonnet. They may be used up to 900 lb. pressure at 750 deg. F.

Jenkins Bros., New York, showed two recent valve designs. One covered a line

of bronze mounted and all iron U-bolt gate valves in sizes to 4 in., featuring a renewable bonnet bushing which can be replaced in the event of worn operating threads. The other comprises a line of 250 and 300 lb. plug type globe valves in sizes to 2 in., equipped with 500-Brinell alloy steel seats and plugs.

A novel type of valve shown by the Walworth Co., New York, is the Anti-Freeze valve for oil storage tanks, a valve with a fusible plug, which automatically closes under spring pressure in the event of fire. The design is such that any ice which may form in the winter will be inside the tank and away from the valve seat.

Automatic Switch Co., New York, showed two new units: an explosion-proof solenoid for controlling valve operation, and three-way pilot valves made up in banks with a manifold so that a number of cylinders or diaphragm valves may be actuated automatically from the same header.

New valve operating equipment was also in evidence. Philadelphia Gear Works, Philadelphia, showed a new rapid-acting valve operator developed particularly for the petroleum industry. Automatic Temperature Control Co., Philadelphia, exhibited a number of types of hydraulically operated valve actuators made by W. F. and John Barnes Co., of Rockford, Ill., for which the Control company is the sales agent. Power is provided by a motor operated gear pump of special design which moves a piston in a cylinder to move the valve stem in the desired direction. The new actuator is said to avoid shocks to the valve, to be adaptable to a wide variety of speed requirements, and to make possible accurate and adjustable overload protection.

An automatic control for stem thrust in high-speed motor-operated valves was featured by Cutler-Hammer, Inc., Milwaukee. By means of an adjustable compression spring between the yoke nut assembly of the valve stem and a fixed portion of the housing, the thrust or pressure of the valve gate against the seat is limited to an amount determined by the initial compression in the spring. Any overthrust between the time the gate is seated and the motor stops after automatic switch cut-off, is taken up by the spring, as is also any change in length of the stem due to temperature differences.

A variety of new developments in water treatment were shown by the Permutit Co., New York. One is the Spaulding Precipitator, a combination mixing, coagulating and settling tank of vertical cylindrical form in which is a central conical chamber for introducing the raw water and treating chemicals. Water flows downward through a zone of mild agitation, then reverses and flows upward through a zone of precipitated solids in suspension. Required filter area is said to be materially decreased. Another development is the Zeo-Carb process, employing a new carbonaceous zeolite, which is practically non-siliceous. This zeolite can be regenerated either with an acid or with NaCl. When regenerated by the former agent, it is capable of removing metallic cations from water, converting carbonates and bicarbonates to $H CO_3$, which is removed by aeration. When regenerated with salt, the zeolite works similarly to previously known zeolites. The first process eliminates hardness and reduces alkalinity. The water may either be neutralized with alkali, or with water which has been put through a salt regenerated zeolite. The net effect is a material reduction in total dissolved solids, and alkalinity reduced as low as desired. The third development is called the De-Mineralite process. As a first treatment stage it employs an acid-regenerated Zeo-Carb unit, and as the second stage, a treatment with the newly developed material, De-Mineralite, which has the property of absorbing the entire acid molecules produced in the first step. The result is that under proper raw water conditions a water approaching distilled water can be produced by purely chemical means.

Several developments in dust handling equipment were evident. Buell Engineering Co., New York, showed a transparent operating model of the recently introduced Van Tongeren dust collector. Prat-Daniel Corp., Port Chester, N. Y., exhibited a new dust sampler consisting of a retractable tube for making a traverse of a duct carrying dusty gases, discharging into a miniature small-diameter cyclone collector equipped with a glass filter bag for recovering the finest particles. Improved devices were shown by the American Air Filter Co., Louisville, Ky., including a self cleaning air filter for moderate volumes known as the Unimatic. Several types of filter media may be employed. Both hand and motor operation are available. A novel feature is that these units have only a single pass through the filter medium. For installations where there is a heavy loading of lint or coarse dust in addition to fine dust, a new armored multi-panel filter element has been introduced, making possible multi-stage air cleaning through a graduated medium of four stages. For the elimination of dust produced by individual machines such as pulverizers, the company has introduced the new Type D self contained Roto-Clone unit, consisting of a small Roto-Clone for removing the bulk of the dust, in series with a large-area filter. Still another development is the company's Cycloil oil bath air cleaner for use on the air intake of engines and compressors. This device uses four stages of dust separation, an impingement on an oil film, a scrubbing against surfaces in contact with oil mist, a cyclonic separation and a filtration.

Examples of liquid handling equipment include a recently improved pump shown by the Quimby Pump Co., Newark, N. J., the rubber lined DB centrifugal pump. As previously built this pump employed a radial discharge. The discharge is now tangential and refinements are evident. The frame has been made more compact, the ball bearing housings fully inclosed and a rubber-lined catchall provided for catching drip from the stuffing box. An improved compressor was one shown by the Nash Engineering Co., South Norwalk, Conn. Available for pressures as high as 75 lb., this Hytor liquid sealed machine features design refinement such as an overhung rotor and both intake and discharge connections in the same plate. The new Moyno pump was shown by Robbins & Meyers, Inc., Springfield, Ohio, together with an even newer adaptation for food industries which may be assembled and disassembled in a matter of seconds. The pump operates by revolving a single-thread double-pitch helical rotor in a double-thread single-pitch stator made usually of hard rubber.

Several new types of materials handling equipment were shown by Barrett-Cravens Co., Chicago. Among these are two new series of lift trucks, all capable of a 3-in. lift. The "Speed Boy" series handles loads to 3,500 lb. and the "Big Boy" series, loads to 15,000 lb. All require a maximum of 15 strokes for lifting and are equipped with hydraulic release checks. The company has developed a line of lift trucks equipped with scales, both beam type and dial scales being available. Depending upon type, capacities range upward to 5,000 lb. One new development is the Jackit system which employs a semi-live skid with wheels at one end and a two-wheeled lifting unit which is detachable from the skid. Another new materials handling development is the Type RB Lo-Hed hoist shown by the American Engineering Co., Philadelphia. This is a motor trolley hoist built in capacities from 1 to 3 tons. Features are four-wheel drive, short wheel base, low cost and low headroom. Control is by pendant ropes or push buttons as desired.

Yale & Towne Mfg. Co., Philadelphia, showed the new Cable King wire rope electric hoist, which is built for close headroom and fingertip control. It was displayed in a variety of models all of which featured cables instead of chains and easy accessibility to motor, gears and switch box. The new Yale center control fork truck was also exhibited which promotes better visibility, balancing power and safety by allowing the operator to ride in front of the battery box.

American Monorail Co., Cleveland, demonstrated the new MonoTractor which is used to drive or pull crane hoist and carrier units on a one-rail overhead track. The unit consists of an electric motor driving a rubber tired wheel against the bottom of the rail from which the entire unit is suspended.

(*Continued in January, 1939, issue*)

# Chemical Engineering NEWS

## Drug and Flavoring Trades Seek Lower Alcohol Tax

Representatives of the drug and flavoring industries, at a conference with Under Secretary of the Treasury, J. W. Hanes, Nov. 10, filed a petition for a reduction in the tax on alcohol used in the making of flavoring extracts.

Unwarranted discrimination in the taxing of alcohol used in flavorings at the rate applied to alcohol for beverage purposes, was charged in the petition.

The associations represented in the petition were: American Association of Colleges of Pharmacy, Prof. W. Price Briggs; American Pharmaceutical Association, S. L. Hilton; Flavoring Extract Manufacturers Association, John S. Hall; Industrial Alcohol Institute, James P. McGovern; National Association of Boards of Pharmacy, A. C. Taylor; National Association of Retail Druggists, Rowland Jones, Jr.; National Association of Fruit and Flavoring Syrups, John S. Hall; National Association of Soda Water Flavors, John S. Hall.

## Alfalfa To Be Studied as Raw Material for Plastics

Proteins in alfalfa as a raw material for plastics manufacturing will be studied at Michigan State College, East Lansing, Michigan, as a part of the Rackham Fund Grant activities, according to V. R. Gardner, director of the Michigan Agricultural Experiment Station.

Dr. Paul Morgal, formerly of the General Chemical Company, will have charge of the alfalfa project. The study will cover the chemistry of the alfalfa proteins in relation to plastics.

Other studies to be undertaken through the Rackham Grant include the development of materials to spray on plants which will reduce transpiration, thus protecting crops in drought or dry areas. This study will be under the direction of Dr. H. G. Petering, formerly of the University of Wisconsin.

Graduate students also will assist in the various research projects.

## Potash Producers Form Export Association

The Potash Export Association, Inc., has filed papers with the Federal Trade Commission, under the Export Trade Act (Webb-Pomerene law) for exporting potassium chloride, potassium sulphate, sulphate of potash magnesia, kainit, and manure salts. The association will maintain offices at 21 East 40th St., New York.

Officers of the association are Dean Clark, president; Paul Speer, vice-president, and Fred N. Oliver, secretary. Directors are Dean Clark, Paul Speer, Horace M. Albright, F. Cecil Baker, G. F. Coope, J. B. Grant and Frederic Vieweg.

Members are American Potash & Chemical Corp., New York; United States Potash Co., New York; and Potash Company of America, Denver.

## Dow Chemical Directors Vote To Absorb Great Western

The board of directors of The Dow Chemical Co. at a meeting held Nov. 19, by unanimous vote of the members present approved an agreement of statutory merger with Great Western Electro-Chemical Co. of Pittsburg, Calif. By the terms of the proposed merger each issued share of 6 per cent cumulative preferred stock, $20 par value, of Great Western would be converted into ⅘ of a share of Dow common stock without par value. and each issued share of common stock without par value of Great Western would be converted into one share of Dow comon stock without par value. Great Western has outstanding 94,550 shares of preferred stock and 69,260 shares of common stock. A special meeting of shareholders of The Dow Chemical Co. will be held at Midland, Michigan, Dec. 22 to vote on the adoption of the proposed agreement.

## Agricultural Chemists to Make Awards for College Theses

Official Agricultural Chemists closed the 54th annual meeting of their association in November at Washington, with formal approval of a plan providing for an annual award for college theses on agricultural chemistry. The award is to be known as the Harvey W. Wiley Memorial Award. Dr. Wiley was founder of the association, and was one of the nation's pioneer agricultural chemists. The association is composed almost exclusively of federal, state, and provincial chemists in the United States and Canada, and is chiefly concerned with the enforcement of laws and control of chemical products of and for agriculture.

The three day conference was devoted largely to technical discussions of methods of testing products to determine exact composition and of ways and means for developing new methods and developing and improving old ones.

Except for brief general sessions the conference took the form of group meetings devoted to beverages, fertilizers, food products, plants, dairy products, paints, drugs, cereals, insecticides, sugars and feed stuffs.

The Wiley award will consist of three money prizes to be given annually to undergraduates of colleges and universities on subjects relating to agricultural chemistry.

## Hooker Electrochemical Will Erect New Office Building

The Hooker Electrochemical Co. will erect a new office and administration building, in connection with its main plant, at Niagara Falls. When completed, some time next year, its principal executive offices will be transferred from 60 East 42d St., New York to Niagara Falls. The company will continue to maintain a New York office. This move is being made in order to concentrate the supervision of operation, sales, research and development at one place, for better service and greater efficiency.

View of Great Western Electro-Chemical plant at Pittsburg, Calif.

## PRODUCTION OF SYNTHETIC FIBERS GAINS GROUND IN GERMANY

**From Our German Correspondent**

CONSTANT improvement is noted in synthetic textile fibers in Germany. Among exhibits at the Leipzig autumn fair was a new "vistra" type fiber which is unusually firm when dry and which holds up better in washing than cotton, and is claimed to be more durable.

Domestic natural fiber production is being pushed, and experiments are underway with every conceivable kind. In Köpenick, near Berlin, experiments have been carried out to see whether the Chinese bast fiber ramie could be grown in Germany. The growth has been so satisfactory that experiments with it will be carried out in six other places in Germany; in East Prussia, Pomerania, Oldenburg, Westphalia, in the Rhineland, and in Bradenburg. From 10,000 to 12,000 young shoots are being raised in hothouses for transplanting. Heretofore Germany has imported ramie fiber from China for manufacture of especially strong yarns and twine. It has been used in Eastern Asia much as linen as been in Europe, for making especially durable clothing, covers, table cloths, etc.

Another experiment with foreign plants is planned in the vicinity of Munich. Over 100 acres of land are being prepared for raising spices and medicinal herbs. Nearly 800 types of plants, including kitchen spices, will be planted.

The oil and fat problem is as important for the consumer of food as for industries. In 1936, 1,600,000 tons of fats were consumed as food, as against 368,000 tons of fats used for technical purposes, 70 per cent of this going into the manufacture of soap. Half of the total fat requirements was supplied domestically. Before the Nuremberg Party Congress, Hermann Göring announced that Germany had a reserve of table fats sufficient to last for 7½ months if there were suddenly no more milk, hogs, etc., produced in the Reich. A decree of recent date also compels all industrial plants to maintain a stock of oils and fats for at least three months of normal production.

Among the various attempts to increase fat production, as previously mentioned in *Chem. & Met.*, the city of Berlin is maintaining 21,000 pigs, which are fed through a collection of kitchen scraps, and this number is soon to be raised to 30,000. Another way in which Germany is trying to increase oil production is to participate more actively in whaling expeditions. With 15 per cent of the total, Germany this year was in third place in production of whale oil, following England and Norway. Eight whaling boats and the mothership "Jan Wellem" left Hamburg recently to catch sperm whales, and six German expeditions arrived in the Antarctic in October. The newly formed German whaling fleet already includes 2,000 men, and the recently established Bremen whaling company will operate next season.

Fish is also becoming more important in German economy both as a foodstuff and as an industrial raw material. As larger German fleets go out, active propaganda is working to encourage people to use more fish products. In this connection a large fishing exhibition will be staged in Hamburg in the spring of 1939. To preserve fish as well as other foods, Germans are following recent refrigeration experiments conducted in Great Britain. According to a process developed there, fish are frozen in a brine solution and kept several degrees below zero until ready for use. The fish is said to retain its original flavor for at least six months, and, in some cases, for as long as two years.

Production of women's shoes from fish leather is increasing. According to the most recent processes, Germans have succeeded in treating fishskin so that it becomes soft enough to be made into gloves. It is stated that the fish leather of two cod fish is sufficient to make a pair of gloves.

In the refrigeration field, carbonic acid "snow" or dry ice can be made more cheaply by a new process. It aims to recover carbonic acid from waste gas of boiler plants, and claims the advantage of low cost since the raw material is recovered from gases which would otherwise go to waste.

Experiments also are being carried out to preserve fresh fruit through so-called gas conservation, by increasing the $CO_2$ of the air, at the same time reducing the oxygen content. The percentage of carbon dioxide varies according to different types of fruit. Another process for conserving vegetables and powdered milk in Germany calls for the application of hydraulic pressure up to 125 atm. Vegetables are dried in warm air and are then pressed into thin sheets, thereby reducing the surface exposed. Pressed spinach treated in this manner is claimed to be easily soluble in warm water and to have almost the same taste as fresh spinach.

With the removal of tariff barriers between Germany and Austria, many changes in production at Austrian factories are necessary, especially in the field of raw materials, since Austrian plants are subject to the same restrictions as in the Reich. Wherever possible they are shifting raw material bases to parallel those of factories in the Reich. To encourage and to explain the use of new synthetic raw materials and substitute metals, a special factory materials exhibition was recently staged by the Verein Deutscher Ingenieure in Vienna.

At the same time Germany is actively carrying out its program to reduce widespread unemployment in Austria, which is now called the "Ostmark," or "Eastern March." Austrian raw materials which the Reich does not possess in abundance also are being developed. In Marchfeld in the Austrian oil district a new petroleum find has been made, and the quality of the oil is stated to be quite good. The German Mansfelder A.G. is investigating Austrian copper deposits in Mitterberg, Radstädter, Tauern, Lungau, and other districts, with the plan of resuming operations in old copper mines and building new refining plants where necessary. Preparatory work has been completed in the vicinity of Linz where extensive phosphorite deposits have been found, and it is planned to undertake regular production.

Two new processes are reported for glueing wood in the production of plywood and veneer. It is claimed that the process yields absolute water proof materials of unusual strength and represents an improvement over previous processes. In glueing the board pressure of at least 10 atm. and a temperature of 140 deg. C. is applied and an acetyl cellulose film or a strong paper film of 1/10 mm. thickness, which has first been impregnated with cresol formaldehyde, is used.

## Chemical Engineers Wanted for Regional Laboratories

The Department of Agriculture is in need of principal chemists and principal chemical engineers at salaries of $5,600 per year according to an announcement by the U.S. Civil Service Commission. The Department expects that the number will exceed 25.

Dr. Henry G. Knight, Chief of the Bureau of Chemistry and Soils, suggests that all persons interested in these examinations communicate at once with the Civil Service Commission, Washington, D. C., in regard to the announcement containing the detailed information concerning the technical qualifications required.

Applicants will be not be required to report for examination but will be rated on education, training and experience as shown on their applications. There is no obligation involved in taking the examination, although in view of the need for qualified persons it is hoped that it will be possible for an applicant to accept a position should one be tendered him.

The list of eligibles from these examinations will be used for the appointment of project leaders in the four regional research laboratories being set up by the Department of Agriculture in accordance with an act of the last Congress.

CHEMICAL engineering research on agricultural materials will have a tremendous boost through the organization of the staff of the new Regional Research Laboratories of the Department of Agriculture. Announcement has been made of Civil Service examination for which applications close the last week in December. At least 25 men at $5600 per year are required as major project leaders in chemical engineering and chemistry. Department officials hope that a very large number of able men will apply so that the major staff positions can be filled with those of experience and talents.

Announcement of the location and the appointment of the directors of these four laboratories is expected to be made by mid-December (probably before this news can be read in *Chem. and Met.*) These four directors will work under the administrative supervision of Dr. Henry G. Knight and of Horace T. Herrick, who are chief and assistant chief of the Bureau of Chemistry and Soils. This assures a chemical staff policy and a relationship with process which should make cooperation of industry easy.

The scope of the research projects to be undertaken will be described in an elaborate report now in preparation which it is hoped the Department can send to Congress early in the new year.

### Monopoly Factors

Department of Justice officials created quite a stir with addresses and publicity statements regarding advertising and patents as a basis of the development of monopolies. Assistant Attorney General Thurman Arnold ran smack into a hornet's nest of publishers, editors, and big company advertisers when his first remarks gave the impression that the Department of Justice would like to supervise the quantity of money which could be spent in advertising and promotion work. Hasty, and altogether sincere, denials of that intention helped somewhat. But apparently there are still plenty of skeptics in Washington, including visitors who come down to see what all this shooting is about.

Clarification of the situation is expected as the Monopoly Committee (TNEC) hearings continue on Capitol Hill. It is expected that the advertising aspects will be fairly soon disposed of there. But the factor of patents as a source of monopoly will remain a major subject of discussion and controversy.

Early presentation by Commerce Department spokesmen to T.N.E.C. emphasizes mere size as a measure of apparent wickedness; and patents are alleged by many of the critics of industry as a major means of creating bigness. Nevertheless good patent practices are being stressed conspicuously, as well as some systems of restrictive pooling that will probably remain under critical fire for sometime.

## NEWS FROM WASHINGTON

**Washington News Bureau**
**McGraw-Hill Publishing Co.**
**Paul Wooton, Chief**

It is not expected that T.N.E.C. will complete its investigations or ask for all of its legislative desires at all soon. It will not surprise Washington if the investigations continue for at least another year. Legislation initiated soon may, therefore, be largely of the trial balloon or camel's nose type.

### Profit Sharing

John Lewis, of C.I.O., and Lammot duPont, of chemical fame, stand shoulder to shoulder before the Congressional committee discussing profit-sharing legislation. Both oppose any plan which would undertake by "incentive legislation" the increase in profit sharing by business. Both favor higher wages paid outright to earners.

At that point the apparent agreement between Lewis and duPont seems to end. Mr. duPont feels that bossing managements by tax pressure is bad. He argues for taxes for revenue only, not taxes which either penalize success or interfere with the freedom of agressive advance into new industry. Mr. Lewis appears to oppose incentive legislation as too keen a possible competitor with the labor union.

Others appearing before the Senate Finance Committee have argued that industry which shares its profits with its employees should have a lower tax rather than other units of business. Those who take such stand are, however, apparently in the small minority of the array of distinguished witnesses who appeared during early December. The chances of profit-sharing legislation seem, therefore, slim.

### Synthetic Mica

Much interest in possible new synthetic materials as a substitute for sheet mica has developed in Washington. This matter was spotlighted by the Tariff Commission when it issued as Report No. 130, Second Series, "The Mica Industry". That document summarizes a survey of the production of mica in the principal producing countries, its preparation, fabrication, uses, and distribution, with special reference to international trade and tariff considerations.

The possibility of synthesis of a material which would take the place of such an important strategic material which must be imported has occasioned much Government attention to the announcement of the recent M.I.T. discovery. Professor Ernst A. Hauser in the department of chemical engineering, with collaborators, has devised a new clay product which by suitable manipulation can be made into transparent sheet products, apparently equal to the best of sheet mica, at least experimentally.

Government men express great gratification that this project is to be developed by Research Corporation to whom the patents and exploitation responsibilities have been assigned by the inventors. The Tariff report above mentioned demonstrates the great industrial possibilities of any such new process, if it can be worked out on an economic basis.

### News "Fines"

Cosmetic Colors—The Food and Drug Administration continues to press on makers of coal-tar dyes who desire to have their products used in the coloring of foods, drugs, and cosmetics under the new Food and Drug law of 1938. Fear of a shortage of adequate material which has been "certified" is leading the officials to urge that both makers and users promptly cooperate with the Administration by having tests made. After next June uncertified colors may not be used.

Food Regulations—Following the hearings of November the Food and Drug Administration agreed to accept until December 10 any further briefs, or criticisms, or comments of the proposed new regulations for the administration of the new law. Consideration of all material submitted at the hearing and by mail is now under way, and it is hoped that early in January the new regulations will be promulgated. In most particulars they do not take full effect until June; but many parts of the Act will be governed by them immediately, especially those features of law and practice not materially changed by the enactment of 1939.

T.V.A. Hearings—The committee investigating T.V.A. renewed activities in mid-November. Although public utility aspects seem still dominant, the committee is far from satisfied about phosphate land purchases and some of the fertilizer features of the Valley activity. Whatever other forms of mis-administration are charged, there seems no evidence of any willful improprieties with respect

to money matters. As one critic admitted, such a new agency could well have been expected to indulge in a little graft; but seemingly it didn't.

Strategic Minerals—The War Department is to have the help of a strong new civilian advisory committee on mineral raw materials of strategic nature. These commodities must be imported from abroad because of domestic shortages or the high cost of domestic production. The new committee is to help the Assistant Secretary of War to bring up-to-date factual matter and to formulate a better preparedness policy. Interested units of industry will be welcome as co-operators.

Wage Hours—It will shortly take more skillful legal advisers to tell an employer what he can do, and what is forbidden under the Fair Labor Standards Act, than it takes to run the tax affairs of business. Despite the best of intentions on the part of Administrator Elmer Andrews the situation gets more complicated daily. The only fortunate thing is that well-intentioned violation of technicalities is not likely to be penalized if corrective measures are taken as soon as employers learn what is expected of them.

Concentrated Phosphates—A.A.A. will buy 75,000 tons of triple superphosphate containing at least 45% of available $P_2O_5$. Firm contracts are being entered into with industrial firms making acceptable offers; but it is expected that probably the largest tonnage of this material will have to come next year, as last, from the output of the Muscle Shoals fertilizer plant of T.V.A.

## Leipsig Fair Announces Spring Session for Next March

The Leipzig Trade Fair will hold its next spring session from March 5 to March 13, inclusive. It will comprise over 10,000 exhibits of the newest products of thirty-four of the leading producing countries, including the United States. An attendance of more than 300,000 business men attracted from seventy-four countries is assured, indicating a general improvement in world trade.

## Lower Sulphur Tax Encourages Mining in Louisiana

Considerable attention has been given to the action of the legislature of Louisiana and the referendum which followed approving an amendment to reduce the severance tax on production of sulphur. The raising of the tax to $2.00 per long ton of sulphur produced resulted in a 23 per cent cut in sulphur mining in that State with a loss in state income, a drop in employment, and a falling in individual purchasing power. The adverse effect of the high tax influenced industrial associations to seek a readjustment and the Freeport Sulphur Co., was asked to proceed with a $300,000 expansion program originally planned for 1936 on the assurance that the tax problem would be dealt with fairly.

The state legislature then proposed an amendment which was passed at the recent electorate and the severance tax was lowered from $2.00 per long ton to $1.03 per long ton with ad valorem taxes on unmined sulphur with constitutional limitation. Production of sulphur in Louisiana for the third quarter of this year has just been reported at 72,520 long tons.

## UNITED KINGDOM AND CANADIAN TRADE TREATIES ALTER IMPORT TARIFFS

### Concessions on U. K. Imports into the United States

| | Before Agreement | Under Agreement |
|---|---|---|
| Stearic acid, value more than 8¢ per lb | 25 p. c. plus 3¢ lb | 15 p. c. plus 3¢ lb |
| Sodium alginate | 25 p. c. | 20 p. c. |
| Ammonium carbonate and bicarbonate | 2¢ lb. | 1¢ lb. |
| Blackings, polishes not containing alcohol | 25 p. c. | 12½ p. c. |
| Precipitated chalk | 25 p. c. | 15 p. c. |
| Cresols — separated cresols (meta, para, and ortho) 75–90 p. c. pure and metaparacresol | | |
| 75–90 p. c. or more pure | 7¢ lb. plus 40 p. c. | 3½¢ lb. plus 20 p. c. |
| Metacresol and paracresol 90 p. c. or more pure | 3½¢ lb. plus 20 p. c. | 3½¢ lb. plus 15 p. c. |
| Orthocresol 90 p. c. or more pure | 3½¢ lb. plus 20 p. c. | 3½¢ lb. plus 15 p. c. |
| Cellulose acetate, not made into finished or partly finished articles | 50¢ lb. | 25¢ lb. |
| Manufactures of sheets, bands, etc. of cellulose film | 60 p. c. | 50 p. c. |
| Myrobalan extract | 15 p. c. | 10 p. c. |
| Mangrove extract | 15 p. c. | 7½ p. c. |
| Flavoring extracts, not containing alcohol | 25 p. c. | 15 p. c. |
| Precipitated magnesium carbonate | 1½¢ lb. | 1¢ lb. |
| Magnesium oxide or calcined magnesia | 7¢ lb. | 5¢ lb. |
| Sod oil | 5¢ gal | 3¢ gal. |
| Refined sperm oil | 14¢ gal. | 7¢ gal. |
| Spermaceti wax | 3½¢ lb. | 2½¢ lb. |
| Wool grease and lanolin: | | |
| Containing more than 2 p. c. free fatty acids | 1¢ lb. plus 3¢ lb. | ½¢ lb. plus 3¢ lb. |
| Containing 2 p. c. or less free fatty acids and not suitable for medicinal use | 2¢ lb. plus 3¢ lb | 1¢ lb. plus 3¢ lb. |
| Suitable for medicinal use | 3¢ lb. plus 3¢ lb. | 2¢ lb. plus 3¢ lb. |
| Palm kernal oil, edible | 1¢ lb. plus processing tax 3¢ lo. | ½¢ lb. plus processing tax 3¢ lb. |
| Bath salts, perfumed | 75 p. c. | 37½ p. c. |
| Enamel paints, N.S.P.F. | 25 p. c. | 15 p. c. |
| Ultramarine blue, value more than 10¢ lb. | 4¢ lb. | 3¢ lb. |
| Litharge | 2½¢ lb. | 2¼¢ lb. |
| Red lead | 2¾¢ lb. | 2¼¢ lb. |
| Lead pigments N.S.P.F. | 30 p. c. | 20 p. c. |
| Umbers, crude and not ground | ½¢ lb. | ¼¢ lb. |
| Synthetic iron oxide and iron hydroxide pigments | 20 p. c. | 15 p. c. |
| Spirit varnishes, containing 5 p. c. or more methyl alcohol | 25 p. c. | 15 p. c. |
| Varnishes, N.S.P.F. | 25 p. c. | 15 p. c. |
| Toilet soap, value more than 20¢ lb. | 30 p. c. | 20 p. c. |
| Leather soap | 15 p. c. | 10 p. c. |
| Sodium chloride or salt in bulk | 7¢ 100 lb. | 4¢ 100 lb. |
| Kaolin or china clay | $2.50 long ton | $1.75 long ton |
| Fullers earth, unwrought | $1.50 long ton | $1 long ton |
| Fullers earth, wrought | $3.25 long ton | $2 long ton |
| Fluorspar, over 97 p. c. calcium fluoride | $5.60 long ton | $4.20 long ton |
| Smalts, frostings, and ceramic and glass colors, fluxes, glazes, and enamels | 30 p. c. | 15 p. c |

### Concessions on Canadian Imports into United States

| | Before Agreement | Under Agreement |
|---|---|---|
| Acetic acid, by weight of acetic acid: | | |
| Not more than 65 p. c. | 1⅜¢ lb. | ¾¢ lb. |
| More than 65 p. c. | 1¾¢ lb. | 1¢ lb. |
| Calcium acetate, crude | 1¢ lb. | ½¢ lb. |
| Shark oil and shark-liver oil, including oil made from sharks known as dogfish, N.S.P. | 20 p. c. | 10 p. c. |
| Tax | 3¢ lb. | 1½¢ lb |
| Black pigments, dry or ground in or mixed with oil or water, N.S.P.. | | |
| Acetylene black | 15 p. c. | 10 p. c. |
| Gas black including carbon black | 20 p. c. | 10 p. c. |
| Salt — In bags, sacks, bbl., or other packages | 11¢ 100 lb. | 7¢ 100 lb. |
| In bulk | 7¢ 100 lb. | 4¢ 100 lb. |
| Hydrated lime | 8¢ 100lb. | 6¢ 100 lb. |
| Talc, steatite, or soapstone, ground, etc., except toilet preparations valued at more than $14 a ton | 25 p. c. | 17½ p. c. |
| Boron carbide | 25 p. c. | 12½ p. c. |

# PERSONALITIES

✦ HAROLD T. BAKER, paper mill engineer and former chief engineer of the Bagley & Sewall Co., has joined the H. A. Ferguson Co., Cleveland, to take charge of the paper mill engineering division.

✦ GEORGE BERNAUER, former chemical engineer of the Milwaukee Sewage Commission, has been appointed resident chemical engineer in Milwaukee for W. H. & L. D. Betz, chemical engineers and consultants of Philadelphia.

✦ C. J. BROCKMAN, associate professor of chemistry at the University of Georgia, has been elected vice-chairman of the Georgia State Board of Registration for Professional Engineers and Surveyors.

✦ TOM BROWN has been appointed manager of the contractors division of the Explosives Department of Hercules Powder Co., succeeding J. J. Kelleher, who resigned last month. He will be located in Wilmington, Del.

✦ B. F. BUCHANAN, formerly instructor in the department of chemistry at Iowa State College, has joined the Technical Service Division of the American Maize-Products Co., New York City, to do work in food research.

✦ ROBERT CALVERT has opened an office in the Chemists' Club, New York City, for the practice of patent law in the chemical industries. Mr. Calvert was formerly engaged in patent work for the Johns-Manville Corp.

✦ WILDER A. CHAPMAN has been appointed manager of laboratories for the Robert W. Hunt Co., consulting engineers, in Chicago.

✦ R. R. COLE has been appointed production manager of the phosphate division of Monsanto Chemical Co. after three years as assistant to the late R. J. Hawn, vice-president. In his new post, Mr. Cole will have charge of phosphate division operations in Anniston, Ala., Columbia, Tenn. and Camden, N. J. His residence and headquarters will be in Anniston.

✦ J. A. DEWINTER, formerly chemical engineer with the Public Service Co. of Indiana, has been appointed resident engineer in the Detroit area for W. H. & L. D. Betz, chemical engineers and consultants.

✦ ROBERT E. GOULD has resigned as chief ceramic engineer of the Tennessee Valley Authority at Norris, Tenn., to become general manager of Buffalo Potteries, Buffalo, N. Y.

✦ W. C. HANSEN, formerly with the American Cyanamid Co. at Linden, N. J., has accepted a position in the research unit of the Portland Cement Association of Chicago.

✦ JOEL H. HILDEBRAND, professor of chemistry at the University of California, has been named to receive the William H. Nichols medal of the American Chemical Society's New York Section. The award will be made at a dinner in New York on March 10.

Three outstanding chemical engineers who were instrumental in development of fiber glass. Left to right: Dr. E. C. Sullivan, director of research of Corning Glass Works; U. E. Bowes, director of research of Owens-Illinois Glass Co.; and Games Slayter, vice-president, Owens-Corning Fiberglas Corp.

Walter C. Rueckel

✦ NORMAN HIXSON, formerly of the technical division of E. I. duPont de Nemours & Co., is now instructor in chemical engineering at the University of Pennsylvania.

✦ CHARLES H. HUGHES, for several years research engineer for Semet Solvay Engineering Corp., has resigned to establish a consulting service in New York City.

✦ R. G. KREILING of the Armour Fertilizer Works has recently been put in charge of all chemical control work for the company.

✦ PAUL LOGUE, formerly vice-president in charge of manufacturing of Swann & Co., Birmingham, Ala., has rejoined the phosphate division of Monsanto Chemical Co., St. Louis.

✦ PAUL D. MILLER has been assigned to physical chemical research at Battelle Memorial Institute, Columbus, Ohio. He was formerly an assistant in the chemistry and physics department of Ohio State University.

✦ DR. KARL MERCK, president of the Assoc. of German Chemists, paid a short visit to New York earlier this month and conferred with American chemical engineers regarding plans for the Second International Congress of Chemical Engineers in Berlin in 1940.

✦ GORDON W. MCBRIDE has resigned as chemical engineer in the Chemical Department of Procter & Gamble Co., Cincinnati, Ohio. Effective Jan. 1, Mr. McBride will become associated with his father, Russell S. McBride, in consulting chemical engineering practice, with offices at 712 Jackson Place, Washington, D. C.

Harold T. Baker

Sidney D. Wells

R. R. Cole

✦ EDWARD E. O'NEAL, JR., has been appointed general superintendent of the Anniston Ala. plant of the phosphate division of Monsanto Chemical Co. Herbert F. Weaver has been appointed assistant general superintendent.

✦ JAMES B. PIERCE has been elected to the presidency of the Barium Reduction Corp., South Charleston, W. Va.

✦ DAVID J. PORTER, Ph.D. in chemical engineering, Pennsylvania State College, 1935, has been appointed assistant professor of chemical engineering at the University of Missouri.

✦ WALTER C. RUECKEL has joined the staff of Battelle Memorial Institute as research ceramic engineer. Dr. Rueckel has been associated with the Koppers Co. for the past three years and prior to that was director of the research bureau of the National Paving Brick Association.

✦ H. H. SCHOPMEYER has been appointed director of research and new products development for the American Maize-Products Co., Robey, Ind., succeeding J. F. Walsh.

✦ ROBERT L. TAYLOR, formerly assistant editor of *Chem. & Met.*, has joined the Public Relations Department of the Monsanto Chemical Co., St. Louis, Mo. Mr. Taylor came to *Chem. & Met.* from the University of Michigan in 1936.

✦ GEORGE R. WAITKINS, formerly of the Solvay Process Co. and the Agfa Ansco Co. has been added to the technical staff of Battelle Memorial Institute to work on problems in industrial organic chemistry.

✦ SIDNEY D. WELLS has joined the staff of the Institute of Paper Chemistry, Appleton, Wis., as research associate and instructor in pulp and paper technology. Mr. Wells has long been identified with the paper industry and for the last three years has been a member of the consulting firm of Paulson & Wells.

✦ G. STAFFORD WHITBY, director of the division of chemistry, National Research Council, Canada, has been appointed to take over the duties of director of the chemical research laboratory at Teddington, England, early in 1939.

✦ JOSEPH D. WHITE, for the past eight years at the U. S. Bureau of Standards as a research chemist for the American Petroleum Institute, has joined the technical staff of W. C. Hardesty Co., Inc., as assistant director of research. He will be located at the company's Dover, Ohio plant.

## OBITUARY

✦ ROBERT M. BARNETTE, 37, a chemist at the Florida Agricultural Experiment Station, was killed in an automobile accident November 1 near Gainesville, Fla.

✦ HARRISON C. BASHIOUM, head of the department of chemical engineering at the University of Pittsburgh for the past twenty years, died at his home on October 30. He was president of the Pittsburgh section of the American Institute of Chemical Engineers.

✦ JOHN W. DAVIS, consulting engineer for the Atmospheric Nitrogen Corp. and the Solvay Process Co., died at Petersburg, Va., October 4, of a heart attack at the age of 51. He is credited with the invention of the process for separating helium from natural gas and during the World War was in charge of helium work for the United States Air Service.

✦ RUSSELL J. HAWN, 60, vice president of Monsanto Chemical Co., died October 14 at his home in Birmingham, Ala. He was in charge of operation of Monsanto's phosphate division and was a recognized authority on phosphorus production.

✦ ALCAN HIRSCH, consulting chemical engineer and vice president of the Hirsch Laboratories in New Rochelle, N. Y., died November 24 at the age of 53.

✦ WARNER D. HUNTINGTON, 64, director of fertilizer sales of the American Cyanamid Co., died in San Francisco on November 25.

✦ HURLBURT S. JACOBY, director of industrial research at Ohio State University and known for his work in chemical plant design, died in Columbus, November 17 at the age of 52.

## CALENDAR

**FEB.** 20-23, TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY, annual meeting, Waldorf-Astoria Hotel, New York City.

**APRIL** 3-7, AMERICAN CHEMICAL SOCIETY, spring meeting, Baltimore, Md.

**APRIL** 16-21, AMERICAN CERAMIC SOCIETY, Hotel Stevens, Chicago, Ill.

**APRIL** 26-29, ELECTROCHEMICAL SOCIETY, spring meeting, Deshler-Wallick Hotel, Columbus, Ohio.

**MAY**, AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Akron, Ohio.

**JUNE** 18-22, AMERICAN ELECTROPLATERS' SOCIETY, international convention, Asbury Park, N. J.

# Chemical ECONOMICS and MARKETS

## RATE OF CHEMICAL CONSUMPTION ACCELERATED IN LAST TWO MONTHS

THE rising trend for the movement of chemicals into consuming channels is still in evidence and the four-month period—July to October inclusive—has recorded a rise in total chemical consumption of slightly more than 21 per cent. Data for October operations revealed that there was a decided increase in the activities of chemical-consuming lines over those for the preceding month The *Chem. and Met.* index for chemical consumption stands at 112.69 for October compared with a revised index of 107.12 for September. Preliminary figures indicate that the index for November will settle around 113 with seasonal influences working in both directions.

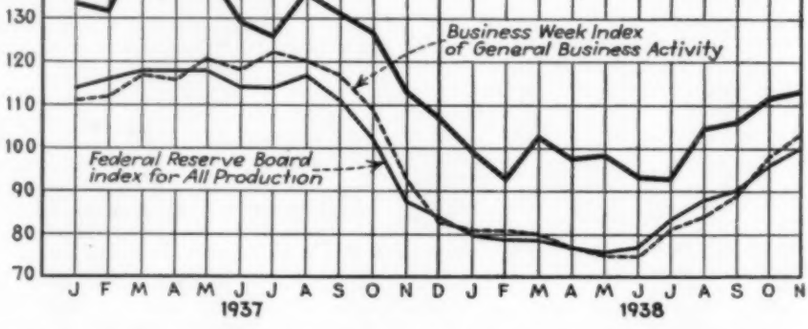
With the exception of the paint and varnish and leather industries, all branches of chemical-consuming trades

***Chem. & Met.* Index for Consumption of Chemicals**

| | September (Revised) | October |
|---|---|---|
| Fertilizer | 21.99 | 24.94 |
| Pulp and paper | 14.26 | 14.40 |
| Glass | 9.34 | 10.42 |
| Petroleum refining | 12.80 | 13.04 |
| Paint and varnish | 10.08 | 9.74 |
| Iron and steel | 6.19 | 6.60 |
| Rayon | 7.95 | 7.77 |
| Textiles | 6.83 | 7.00 |
| Coal products | 5.43 | 6.27 |
| Leather, glue and gelatine | 4.17 | 3.90 |
| Explosives | 4.44 | 4.69 |
| Rubber | 2.14 | 2.30 |
| Plastics | 1.50 | 1.62 |
| | 107.12 | 112.69 |

contributed to the larger movement of raw materials in October. Fertilizer manufacturers following the seasonal trend, stepped up operations and glass producers operated at the highest levels of the year with some branches operating still more actively in November. Textile mills consumed larger amounts of all raw materials except silk but silk deliveries to mills in November amounted to 41,559 bales as against 35,631 bales reported for September. Iron and steel mills held a higher rate of operation in November than in any preceding month of the year and sulphate of ammonia production also was the best for the year.

Preliminary figures place the Federal Reserve index of industrial production at about 100 for November in contrast with 96 for October. The index for general business activity compiled by *Business Week* is 103 for November and 98.5 for October.




The outlook for December is mixed because of the conflicting trends in the different industries. Automotive production will run higher than in any other month of 1938 and probably will approximate the July 1937 output of 438,971 units. Superphosphate production will advance but not to the same extent as a year ago. In 1937 superphosphate production ran considerably above the rate of fertilizer and the large carryover of stocks has had an adverse effect upon production this year although 1938 production will make a very favorable showing with that for previous years if 1937 is eliminated from the comparison.

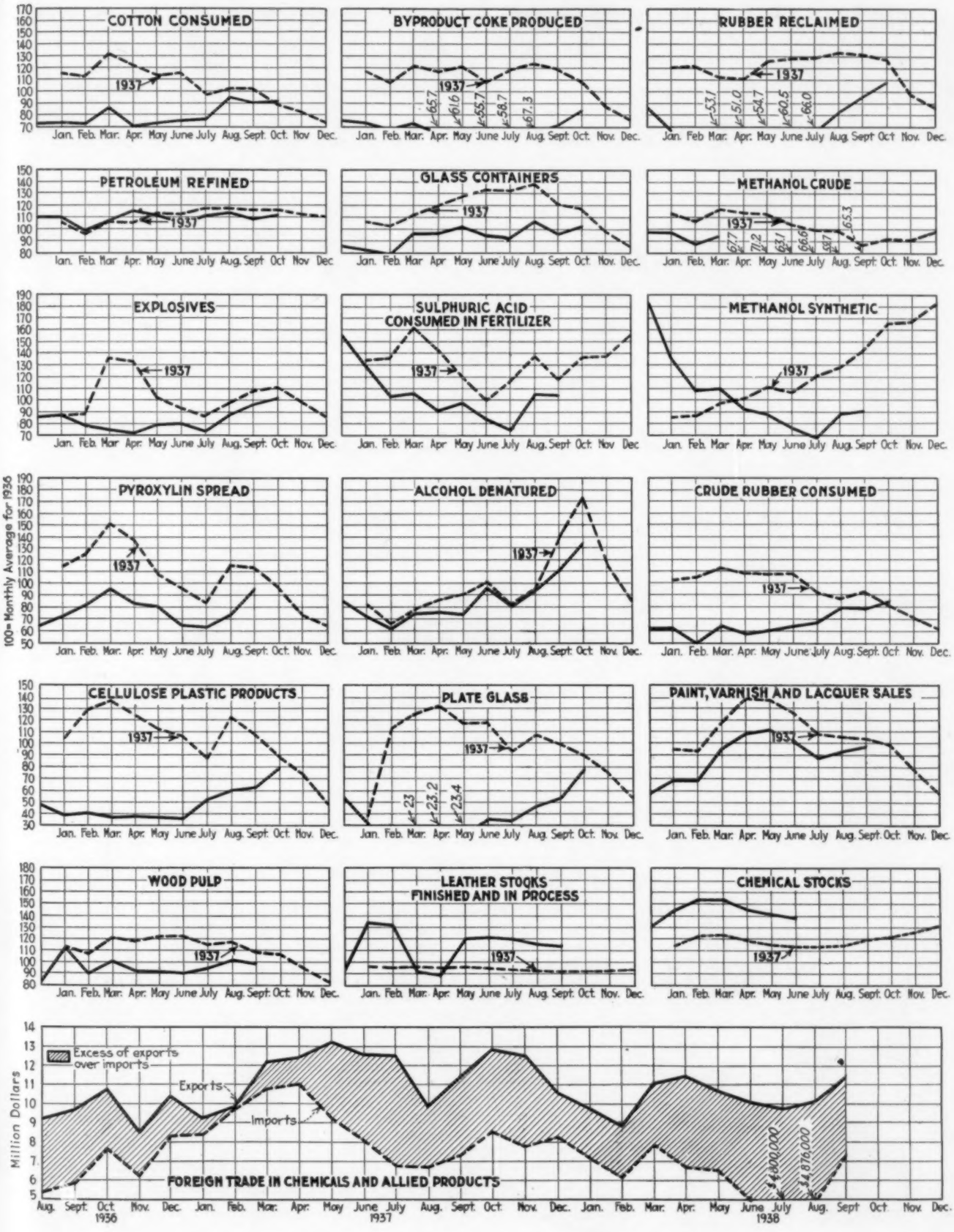
December, however, is expected to bring some drop in the rate of operations at steel mills, at paint and varnish plants, and in other industries where year-end inventory periods create a downward seasonal trend. Output of glass in December will show some tapering off from the high point of late November but the year-end slow down will be of shorter duration than usual and total production for the month may exceed that for other months of the year with the exception of November.

Trade agreements recently concluded have been under digestion with reference to their effects upon domestic production. The downward revision of duty on acetic acid is expected to result in greater competition from Canadian importations and bring about some curtailment at domestic producing plants. The zinc mining industry also is disturbed over the outlook which forecasts the loss of part of the home market to Canadian producers and this of course has a more or less direct bearing on the market for all zinc salts.

**Production and Consumption Data for Chemical-consuming Industries**

| | Oct. 1938 | Oct. 1937 | Jan.–Oct. 1938 | Jan.–Oct. 1937 | Per cent of decline for 1938 |
|---|---|---|---|---|---|
| **Production** | | | | | |
| Alcohol, ethyl, 1000 pr. gal | 17,017 | 18,786 | 160,692 | 179,897 | 10.7 |
| Alcohol, denatured, 1000 wi. gal | 11,101 | 14,364 | 72,272 | 82,253 | 12.1 |
| Automobiles, no | 209,522 | 329,876 | 1,628,851 | 4,122,685 | 60.5 |
| Benzol, 1000 gal | 7,100 | 9,610 | 55,941 | 103,202 | 45.8 |
| By product coke, 1000 tons | 3,093 | 4,036 | 25,156 | 43,165 | 41.7 |
| Glass containers, 1000 gr | 3,866 | 4,548 | 32,374 | 40,848 | 20.7 |
| Plate glass, 1000 sq. ft | 12,869 | 14,855 | 60,151 | 171,155 | 64.8 |
| Cellulose acetate plastics, 1000 lb | 945 | 919 | 4,387 | 11,828 | 63.0 |
| Vitrocellulose plastics, 1000 lb | 1,051 | 1,283 | 7,681 | 16,053 | 52.2 |
| Rubber reclaimed, tons | 13,558 | 15,849 | 85,980 | 155,551 | 44.7 |
| **Consumption** | | | | | |
| Cotton, bales | 542,778 | 526,464 | 4,743,769 | 6,504,963 | 27.1 |
| Silk, bales | 35,631 | 36,002 | 334,991 | 371,568 | 9.8 |
| Wool, scoured, 1000 lb | 33,279 | 21,519 | 214,092 | 326,850 | 34.5 |
| Explosives, 1000 lb | 32,151 | 34,810 | 262,489 | 329,396 | 20.3 |
| Rubber, tons | 40,333 | 38,707 | 319,879 | 478,198 | 33.1 |
| Waste paper, tons | 267,193 | 256,162 | 2,322,379 | 2,995,550 | 22.5 |

# Production and Consumption Trends



## PRODUCERS OF CHEMICALS HAVE LARGE PART OF OUTPUT SOLD AHEAD

PLACEMENT of contract orders for 1939 delivery and analysis of recently adopted trade agreements to determine the probable effects of their embodied tariff revisions, were the outstanding developments in the market for chemicals in the last month. In the majority of cases, new contract prices consisted of an extension of the figures which were effective for 1938 deliveries. In the case of alkalis, quotations have been given by producers which are in line with the figures at which sales are made. For instance, soda ash in bulk is offered at 90c per 100 lb. carlots, at $1.05 per 100 lb. in bags, and at $1.35 in bbl. Solid caustic soda is quoted at $2.30 per 100 lb. in drums and 70 per cent liquid at $2.00 per 100 lb. in sellers tanks. In former years, higher quotations were issued by producers but they were nominal and obtained prices were about the same as those now ruling as reports credit new contracts being written at unchanged price levels.

The new trade agreement with the United Kingdom records a sharp drop in our import tariff on separated cresols with a smaller reduction of the duty on the pure product. The agreement with Canada carries important reductions in high and low strength acetic acid and competition in this product promises to develop. Lower duties on imports of metals also may have considerable effect in domestic markets not only in the case of the metals but also extending to metal salts.

In November considerable uneasiness resulted from the uncertainty regarding the movement of tung oil from the interior of China. Under date of December 1, the Department of Commerce reported that after being closed to merchant vessels for many months, shipping is again moving on the Yangtze River. At least twenty Chinese transportation companies, working under special arrangements with the authorities, are handling freight by water, rail and highways, between Shanghai and interior points as far as Wuhu, which is 250 miles up the river. Japanese shipping is reported active on the Yangtze to such points as Nantungchow, Chingkiang, Nanking, and Wuhu, and in a more limited way as far as Hankow. Approximately 600 short tons of tung oil is reported to be included among the commodities now en route from Hankow to Shanghai. Tung oil also is continuing to move to world markets from South China. Approximately 30 short tons are arriving daily at Hong Kong from Kwangsi and Hunan Provinces. In October, exports of tung oil from Hong Kong aggregated 7,297,000 lb—6,511,000 lb. going directly to the United States and most of the remainder to Europe. The Dai Nippon (Great Japan) Paint Co., located in the Yangtze Poo District of Shanghai, is reported to have obtained a temporary charter from the Japanese military authorities to handle the tung oil trade of Hankow.

Up to the latter part of the period there was a declining trend to values for naval stores with the report current that no further government loans were available but the market later staged a recovery. The semi-annual report issued by the Department of Agriculture places production of turpentine for the first six months of the 1938-39 season at 463,370 50-gal. bbl. which compares with 444,879 50-gal. for the comparable period of the 1937-38 season. For the same periods, production of rosin was reported at 1,635,207 500-lb. bbl. and 1,543,940 500-lb. bbl. for the 1938-39 and 1937-38 seasons respectively. Carry over stocks on Sept. 30 consisted of 354,981 bbl. of turpentine and 1,581,530 bbl. of rosin as against 280,199 bbl. and 912,922 bbl. held on Sept. 30, 1937.

Consumption of turpentine and rosin for the Apr.-Sept. six months fell off materially from the totals for the like 1937 interval, the decline including smaller amounts taken by domestic consumers and reduced shipments in the export trade. Domestic consumption of turpentine for the six-month periods was 224,717 bbl. in 1938 and 236,715 bbl. in 1937. Consumption of rosin was 613,502 bbl. in 1938 and 683,849 bbl. in 1937. The soap and printing ink industries ran counter to the general trend and increased their buying of both rosin and turpentine in the current year.

In the foreign trade, imports of turpentine were larger with Mexico supplying the greater part of receipts. Export trade was on the down grade with outward shipments of turpentine reaching a total of 110,123 bbl. compared with 156,639 bbl. for 1937 and exports of rosin amounting to 439,783 bbl. or 170,969 bbl. below the six-month shipments last year. The drop in export trade in rosins, however, was confined to the gum variety as wood rosin exports showed a gain of more than 27 per cent for the 1938 period.

Of interest to producers of methanol is a report from James M. Doran, former Commissioner of Industrial Alcohol, who has recently returned from a visit to Ireland, and advises there is a market for denaturing grade methanol in that country. Mr. Doran reported that methanol is the most widely used denaturant in the British Isles, and that the supply now used in Ireland is obtained largely from Germany, at prices higher than those in the United States. Ireland also is experimenting with the use of alcohol as a motor fuel on a large scale, and on July 1, the Commissioner of Industry and Commerce decreed that commercial trucking firms in the Dublin area use a gasolene blend containing 20 per cent alcohol.

On the authority of our commercial attache at Buenos Aires, shipments of casein from the Argentine have fallen off to a marked degree with Finland and Sweden the only counties to increase their takings in the first nine months of this year compared with 1937 comparable period. Data compiled by the Bureau of Dairy Industry of the Ministry of Agriculture, which differ somewhat from the figures of the Government Statistical Office, indicate a declining trend for exports in the last three years with the Jan.-Sept. totals in metric tons, being 14,864, 12,406, and 9,025 for 1936, 1937, and 1938 respectively. Germany accounted for 6,100 metric tons of the 1936 total, 3,235 metric tons in 1937, and 1,772 metric tons in 1938. Shipments to the United States in metric tons for the nine month periods were 2,308 in 1936, 1,408 in 1937, and 102 in 1938.

### CHEM. & MET.

**Weighted Index of**

### CHEMICAL PRICES

Base=100 for 1935

| | |
|---|---|
| **This month** | **99.01** |
| Last month | 99.00 |
| December, 1937 | 101.50 |
| December, 1936 | 98.33 |

Average price level was very little changed. Advances in basic lead carbonate, lead sulphate, and ammonium sulphate were largely offset by reductions in turpentine and lead oxides. Tin salts also were easier and zinc dust sold off from previous levels.

### CHEM. & MET.

**Weighted Index of Prices for**

### OILS AND FATS

Base=100 for 1935

| | |
|---|---|
| **This month** | **75.80** |
| Last month | 75.19 |
| December, 1937 | 84.96 |
| December, 1936 | 108.73 |

Prices were irregular with China wood and linseed oils higher and some of the other oils lower. Contradictory cables have been received regarding future shipments of wood oil from China. Tallow and greases closed at advances.

# Current PRICES

## INDUSTRIAL CHEMICALS

| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Acetone, drums, lb. | $0.05½–$0.06½ | $0.05½–$0.06½ | $0.05½–$0.06½ |
| Acid, acetic, 28%, bbl., cwt. | 2.23 – 2.48 | 2.23 – 2.48 | 2.38 – 2.63 |
| Glacial 99%, drums | 8.43 – 8.68 | 8.43 – 8.68 | 8.43 – 8.68 |
| U. S. P. reagent | 10.25 –10.50 | 10.25 –10.50 | 10.25 –10.50 |
| Boric, bbl., ton | 106.00–111.00 | 106.00–111.00 | 105.00–115.00 |
| Citric, kegs, lb. | .23½– .25 | .23½– .25 | .24 – .27 |
| Formic, bbl., ton | .10½– .11 | .10½– .11 | .10½– .11 |
| Gallic, tech., bbl., lb. | .70 – .75 | .70 – .75 | .75 – .78 |
| Hydrofluoric 30% carb., lb. | .07 – .07½ | .07 – .07½ | .07 – .07½ |
| Lactic, 44%, tech., light, bbl., lb. | .06½– .06½ | .06½– .06½ | .6½ – .6½ |
| Muriatic, 18°, tanks, cwt. | 1.05 –..... | 1.05 –..... | 1.05 –..... |
| Nitric, 36°, carboys, lb. | .05 – .05½ | .05 – .05½ | .05 – .05½ |
| Oleum, tanks, wks., ton | 18.50 –20.00 | 18.50 –..... | 18.50 –20.00 |
| Oxalic, crystals, bbl., lb. | .10½– .12 | .10½– .12 | .10½– .12 |
| Phosphoric, tech., c'bys., lb. | .07½– .08½ | .09 – .10 | .09 – .10 |
| Sulphuric, 60°, tanks, ton | 13.00 –..... | 13.00 –..... | 13.00 –..... |
| Sulphuric, 66°, tanks, ton | 16.50 –..... | 16.50 –..... | 16.50 –..... |
| Tannic, tech., bbl., lb. | .40 – .45 | .40 – .45 | .40 – .45 |
| Tartaric, powd., bbl., lb. | .27½– .... | .27½–..... | .24½–..... |
| Tungstic, bbl., lb. | 2.75 –..... | 2.75 –..... | 2.75 –..... |
| Alcohol, Amyl | –..... | –..... | –..... |
| From Pentane, tanks, lb. | .106–..... | .106–..... | .123–..... |
| Alcohol, Butyl, tanks, lb. | .08½–..... | .08½–..... | .08½–..... |
| Alcohol, Ethyl, 190p'f., bbl., gal. | 4.61½–..... | 4.61½–..... | 4.14 –..... |
| Denatured, 190 proof | | | |
| No. 1 special, dr., gal wks. | .30 –..... | .30 –..... | .34 –..... |
| Alum, ammonia, lump, bbl., lb. | .03½– .04 | .03½– .04 | .03 – .04 |
| Potash, lump, bbl., lb. | .03½– .04 | .03½– .04 | .03½– .04 |
| Aluminum sulphate, com bags cwt. | 1.15 – 1.40 | 1.15 – 1.40 | 1.35 – 1.50 |
| Iron free, bg., cwt. | 1.30 – 1.55 | 1.30 – 1.55 | 2.00 – 2.25 |
| Aqua ammonia, 26°, drums, lb. | .02 – .03 | .02 – .03 | .02½– .03 |
| tanks, lb. | .02 – .02½ | .02 – .02½ | .02½– .02½ |
| Ammonia, anhydrous, cyl., lb. | .15½–..... | .15½–..... | .15½– .16 |
| tanks, lb. | .04½–..... | .04½–..... | .04½–..... |
| Ammonium carbonate, powd tech., casks, lb. | .08 – .12 | .08 – .12 | .08 – .12 |
| Sulphate, wks., cwt. | 1.3875– | 1.375– | 1.40 –..... |
| Amylacetate tech., tanks, lb. | .9½ –..... | .09½– .12 | .11 – .11½ |
| Antimony Oxide, bbl., lb. | .11½– .12 | .11½– .12 | .14½– .15 |
| Arsenic, white, powd., bbl., lb. | .03 – .03½ | .03 – .03½ | .03 – .03½ |
| Red, powd., kegs, lb. | .15½– .16 | .15½– .16 | .15½– .16 |
| Barium carbonate, bbl., ton | 52.50 –57.50 | 52.50 –57.50 | 52.50 –57.50 |
| Chloride, bbl., ton | 79.00 –81.00 | 79.00 –81.00 | 79.00 –81.00 |
| Nitrate, cask, lb. | .07 – .08 | .07 – .08 | .07 – .08 |
| Blanc fixe, dry, bbl., lb. | .03½– .04 | .03½– .04 | .03½– .04 |
| Bleaching powder, f. o b., wks., drums, cwt. | 2.00 – 2.10 | 2.00 – 2.10 | 2.00 – 2.10 |
| Borax, gran., bags, ton | 48.00 –51.00 | 48.00 –51.00 | 46.00 –51.00 |
| Bromine, cs., lb. | .30 – .32 | .30 – .32 | .30 – .32 |
| Calcium acetate, bags | 1.65 –..... | 1.65 –..... | 1.65 –..... |
| Arsenate, dr., lb. | .06½– .07 | .06½– .07 | .06½– .07 |
| Carbide drums, lb. | .05 – .06 | .05 – .06 | .05 – .06 |
| Chloride, fused, dr., del., ton | 21.50 –24.50 | 21.50 –24.50 | 20.00 –33.00 |
| flake, dr., del., ton | 23.00 –25.00 | 23.00 –25.00 | 22.00 –35.00 |
| Phosphate, bbl., lb. | .07½– .08 | .07½– .08 | .07½– .08 |
| Carbon bisulphide, drums, lb. | .05 – .06 | .05 – .06 | .05 – .06 |
| Tetrachloride drums, lb. | .04½– .05½ | .04½– .05½ | .05½– .06 |
| Chlorine, liquid, tanks, wks., lb. | 2.15 –..... | 2.15 –..... | 2.15 –..... |
| Cylinders | .05½– .06 | .05½– .06 | .05½– .06 |
| Cobalt oxide, cans, lb. | 1.67 – 1.70 | 1.67 – 1.70 | 1.67 – 1.70 |
| Copperas, bgs., f.o.b., wks., ton | 15.00 –16.00 | 15.00 –16.00 | 15.00 –16.00 |
| Copper carbonate, bbl., lb. | .10 – .16½ | .10 – .16½ | .09 – .16 |
| Sulphate, bbl., cwt. | 4.50– 4.75 | 4.50 – 4.75 | 4.50 – 4.75 |
| Cream of tartar, bbl., lb. | .22½– .23 | .22½– .23 | .19½– .20 |
| Diethylene glycol, dr., lb. | .22 – .23 | .22 – .23 | .22 – .23 |
| Epsom salt, dom., tech., bbl., cwt. | 1.80 – 2.00 | 1.80 – 2.00 | 1.80 – 2.00 |
| Ethyl acetate, drums, lb. | .06½–..... | .06½–..... | .07½–..... |
| Formaldehyde, 40%, bbl., lb. | .05½– .06½ | .05½– .06½ | .05½– .6½ |
| Furfural, dr., lb | .10 – .17½ | .10 – .17½ | .10 – .17½ |
| Fusel oil, ref. drums, lb. | .12½– .14 | .12½– .14 | .12½– .14 |
| Glaubers salt, bags, cwt. | .95 – 1.00 | .95 – 1.00 | .95 – 1.00 |
| Glycerine, c.p., drums, extra, lb. | .14½–..... | .14½–..... | .15½–..... |
| Lead: | | | |
| White, basic carbonate, dry casks, lb. | .07 –..... | .06½–..... | .06½–..... |
| White, basic sulphate, sck., lb. | .06½–..... | .06 –..... | .06½–..... |
| Red, dry, sck, lb. | .07½–..... | .08 – ..... | .07½–..... |
| Lead acetate, white crys., bbl., lb. | .10 – .11 | .10 – .11 | .12 – .13 |
| Lead arsenate, powd., bbl., lb. | .11 – .11½ | .11 – 11½ | .11½– .12 |
| Lime, chem., bulk, ton | 8.50 –..... | 8.50 –..... | 8.50 –..... |
| Litharge, pwd., csk., lb. | .06½–..... | .066–..... | .06½–..... |
| Lithophone, bags, lb. | .04½– .04½ | .04½– .04½ | .04½– .05 |
| Magnesium carb., tech., bags, lb. | .14½– .06½ | .06 – .06½ | .06 – .06½ |

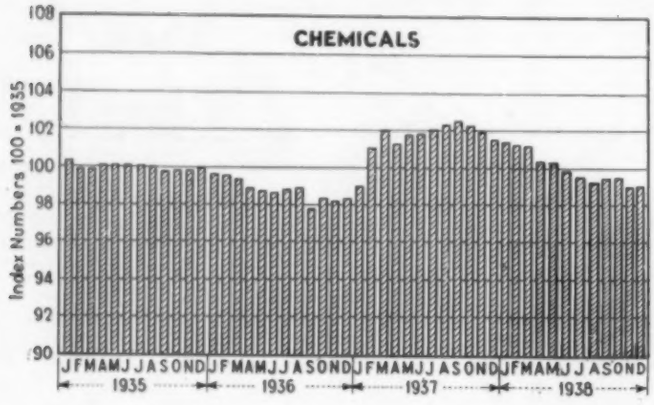
| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Methanol, 95%, tanks, gal. | .31 –..... | .31 –..... | .31 –..... |
| 97%, tanks, gal. | .32 –..... | .32 –..... | .32 –..... |
| Synthetic, tanks, gal. | .33 –..... | .33 –..... | .33 –..... |
| Nickel salt, double, bbl., lb. | .13 – .13½ | .13 – .13½ | .13 – .13½ |
| Orange mineral, csk., lb. | .10½–..... | .10½–..... | .10½–..... |
| Phosphorus, red, cases, lb. | .40 – .42 | .40 – .42 | .40 – .42 |
| Yellow, cases, lb. | .24 – .30 | .24 – .30 | .24 – .30 |
| Potassium bichromate, casks, lb. | .08½– .09 | .08½– .09 | .08½– .09 |
| Carbonate, 80–85%, calc. csk., lb. | .05½– .06 | .05½– .06 | .06½ .07 |
| Chlorate, powd., lb. | .09½–..... | .09½–..... | .09½– ..... |
| Hydroxide (c'stic potash) dr., lb. | .07 – .07½ | .07 – .07½ | .07 – .07½ |
| Muriate, 80% bgs., unit. | .53½–..... | .53½–..... | .53½–..... |
| Nitrate, bbl. lb. | .05½– .06 | .05½– .06 | .05½– .06 |
| Permanganate, drums, lb. | .18½– .19 | .18½– .19 | .18½– .19 |
| Prussiate, yellow, casks, lb. | .15 – .16 | .15 – .16 | .15 – .16 |
| Sal ammoniac, white, casks, lb. | .05 – .05½ | .05 – .05½ | .05 – .05½ |
| Salsoda, bbl., cwt. | 1.00 – 1.05 | 1.00 – 1.05 | 1.00 – 1.05 |
| Salt cake, bulk, ton | 13.00 –15.00 | 13.00 –15.00 | 13.00 –15.00 |
| Soda ash, light, 58%, bags, contract, cwt. | 1.23 –..... | 1.23 –..... | 1.23 –..... |
| Dense, bags, cwt. | 1.25 –..... | 1.25 –..... | 1.25 –..... |
| Soda, caustic, 76%, solid, drums, contract, cwt. | 2.60 – 3.00 | 2.60 – 3.00 | 2.60 – 3.00 |
| Acetate, works, bbl., lb. | .04 – .05 | .04 – .05 | .04½– .05 |
| Bicarbonate, bbl., cwt. | 1.75 – 2.00 | 1.75 – 2.00 | 1.75 – 2.00 |
| Bichromate, casks, lb. | .06½– .07 | .06½– .07 | .06½– .07 |
| Bisulphate, bulk, ton | 15.00 –16.00 | 15.00 –16.00 | 15.00 –16.00 |
| Bisulphite, bbl., lb. | .03½– .04 | .03½– .04 | .03½– .04 |
| Chlorate, kegs, lb. | .06½– .06½ | .06½– .06½ | .06½– .06½ |
| Chloride, tech., ton | 12.00 –14.75 | 12.00 –14.75 | 12.00 –14.75 |
| Cyanide, cases, dom., lb. | .14 – .15 | .14 – .15 | .16½– .17 |
| Fluoride, bbl., lb. | .07½– .08 | .07½– .08 | .07½– .08 |
| Hyposulphite, bbl., cwt. | 2.40 – 2.50 | 2.40 – 2.50 | 2.40 – 2.50 |
| Metasilicate, bbl., cwt. | 2.20 – 3.20 | 2.20 – 3.20 | 2.15 – 3.15 |
| Nitrate, bags, cwt. | 1.45 –..... | 1.45 –..... | 1.45 –..... |
| Nitrite, casks, lb. | .06½– .07 | .06½– .07 | .07 – .08 |
| Phosphate, dibasic, bags, lb. | 1.85 –..... | 1.85 –..... | 1.85 – .024 |
| Prussiate, yel. drums, lb. | .09½– .10 | .09½– .10 | .10 – .11 |
| Silicate (40° dr.) wks., cwt. | .80 – .85 | .80 – .85 | .80 – .85 |
| Sulphide, fused, 60–62%, dr., lb. | .02½– .03½ | .02½– .03 | .02½– .03 |
| Sulphite, cyrs., bbl., lb. | .02½– .02½ | .02½– .02½ | .02½– .02½ |
| Sulphur, crude at mine, bulk, ton. | 16 00 –..... | 16.00 –..... | 18.00–..... |
| Chloride, dr., lb. | .03 – .04 | .03 – .04 | .03½– .04 |
| Dioxide, cyl., lb. | .07 – .08 | .07 – .08 | .07 – .07½ |
| Flour, bag, cwt. | 1.60 – 3.00 | 1.60 – 3.00 | 1.60 – 3.00 |
| Tin Oxide, bbl., lb. | .50 –..... | .50 –..... | .50 –..... |
| Crystals, bbl., lb. | .36 –..... | .36½–..... | .35 –..... |
| Zinc. chloride, gran., bbl., lb. | .05 – .06 | .05 – .06 | .05 – .06 |
| Carbonate, bbl., lb. | .14 – .15 | .14 – .15 | .14 – .15 |
| Cyanide, dr., lb. | .33 – .35 | .33 – .35 | .36 – .38 |
| Dust, bbl., lb. | .06½–..... | .07 –..... | .077–..... |
| Zinc oxide, lead free, bag., lb. | .06½–..... | .06½–..... | .06½–..... |
| 5% lead sulphate, bags, lb. | .06½–..... | .06½–..... | .06½–..... |
| Sulphate, bbl., cwt. | 3.15 – 3.60 | 3.15 – 3.60 | 3.15 – 3.60 |

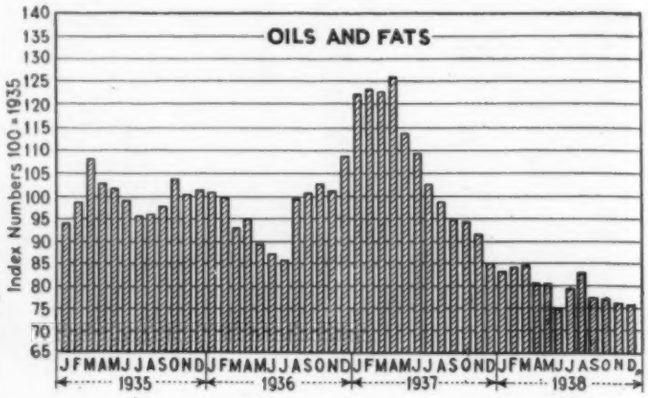
## OILS AND FATS

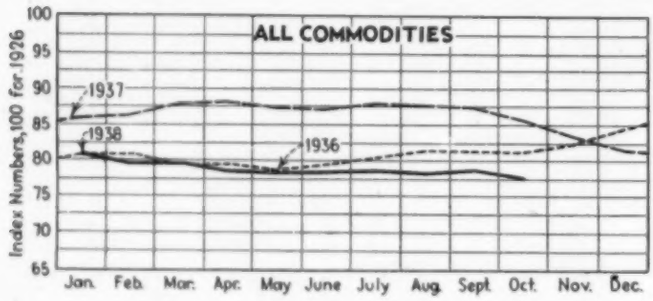
| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Castor oil, No. 3, bbl., lb. | $0.09½–$0.10 | $0.09½–$0.10 | $0.10½–$0.11 |
| Chinawood oil, bbl., lb. | .14½–..... | .14 –..... | .14½–..... |
| Coconut oil, Ceylon, tanks, N. Y. lb. | .03½–..... | .03 –..... | .04 –..... |
| Corn oil crude, tanks (f.o.b. mill), lb. | .06½–..... | .06½–..... | .06½–..... |
| Cottonseed oil, crude (f.o.b. mill), tanks, lb. | .06½–..... | .06½–..... | .05½–..... |
| Linseed oil, raw car lots, bbl., lb. | .085–..... | .085–..... | .104–..... |
| Palm, casks, lb. | .03½–..... | .036–..... | .04 –..... |
| Peanut oil, crude, tanks (mill), lb. | .06½–..... | .06½–..... | .06½–..... |
| Rapeseed oil, refined, bbl., gal. | .82 –..... | .78 –..... | .90 –..... |
| Soya bean, tank, lb. | .05½–..... | .05½–..... | .06 –..... |
| Sulphur (olive foots), bbl., lb. | .07 –..... | .06½–..... | .09½–..... |
| Cod, Newfoundland, bbl., gal. | .38 –..... | .38 –..... | .52 –..... |
| Menhaden, light pressed, bbl., lb. | .067–..... | .063–..... | .074–..... |
| Crude, tanks (f.o.b. factory), gal. | .30 –..... | .30 –..... | .34 –..... |
| Grease, yellow, loose, lb. | .05 –..... | .04½–..... | .05 –..... |
| Oleo stearine, lb. | .06½–..... | .06½–..... | .09 –..... |
| Oleo oil, No. 1 | .09 –..... | .09½–..... | .09 –..... |
| Red oil, distilled, d.p. bbl., lb. | .07½–..... | .08½–..... | .09½–..... |
| Tallow extra, loose, lb. | .05½–..... | .05½–..... | .06½–..... |

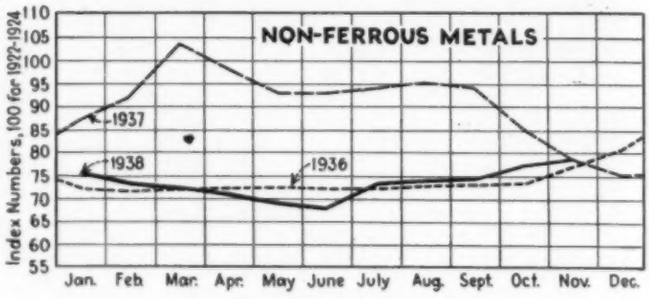
**The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Dec. 12**

# Chem. & Met.'s Weighted Price Indexes




## COAL-TAR PRODUCTS

| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Alpha-napthol, crude, bbl., lb. | $0.52 -$0.55 | $0.52 -$0.55 | $0.52 -$0.55 |
| Alpha-naphthylamine, bbl., lb. | .32 - .34 | .32 - .34 | .32 - .34 |
| Aniline oil, drums, extra, lb. | .15 - .16 | .15 - .16 | .15 - .16 |
| Aniline salts, bbl., lb. | .22 - .24 | .22 - .24 | .22 - .24 |
| Benzaldehyde, U.S.P., dr., lb. | .85 - .95 | .85 - .95 | .85 - .95 |
| Benzidine base, bbl., lb. | .70 - .75 | .70 - .75 | .70 - .75 |
| Benzoic acid, U.S.P., kgs., lb. | .54 - .56 | .54 - .56 | .52 - .54 |
| Benzyl chloride, tech., dr., lb. | .23 - .25 | .23 - .25 | .25 - .27 |
| Benzol, 90%, tanks, works, gal. | .16 - .18 | .16 - .18 | .16 - .18 |
| Beta-napthol, tech., drums, lb. | .23 - .24 | .23 - .24 | .23 - .24 |
| Cresol, U.S.P., dr., lb. | .10 - .11 | .10½ - .11 | .12 - .13 |
| Cresylic acid, dr., wks., gal. | .69 - .71 | .78 - .80 | .92 - 1.00 |
| Diethylaniline, dr., lb. | .40 - .45 | .40 - .45 | .50 - .55 |
| Dinitrophenol, bbl., lb. | .23 - .25 | .23 - .25 | .23 - .25 |
| Dinitrotoluen, bbl., lb. | .15 - .16 | .15 - .16 | .15 - .16 |
| Dip oil, 15%, dr., gal. | .23 - .25 | .23 - .25 | .23 - .25 |
| Diphenylamine, bbl., lb. | .32 - .36 | .32 - .36 | .32 - .36 |
| H-acid, bbl., lb. | .50 - .55 | .50 - .55 | .50 - .55 |
| Naphthalene, flake, bbl., lb. | .05½ - .06 | .05½ - .06 | .07½ - .07⅝ |
| Nitrobenzene, dr., lb. | .08 - .09 | .08 - .09 | .08 - .09 |
| Para-nitraniline, bbl., lb. | .47 - .49 | .47 - .49 | .45 - .47 |
| Phenol, U.S.P., drums, lb. | .14½ - ..... | .14½ - ..... | .14½ - ..... |
| Picric acid, bbl., lb. | .35 - .40 | .35 - .40 | .35 - .40 |
| Pyridine, dr., gal. | 1.55 - 1.60 | 1.55 - 1.60 | 1.55 - 1.60 |
| Resorcinal, tech., kegs, lb. | .75 - .80 | .75 - .80 | .75 - .80 |
| Salicylic acid, tech., bbl., lb. | .33 - .40 | .33 - .40 | .34 - .40 |
| Solvent naptha, w.w., tanks, gal. | .26 - ..... | .26 - ..... | .30 - ..... |
| Tolidine, bbl., lb. | .86 - .88 | .86 - .88 | .88 - .90 |
| Toluene, tanks, works, gal. | .27 - ..... | .27 - ..... | .35 - ..... |
| Xylene, com, tanks, gal. | .26 - ..... | .26 - ..... | .35 - ..... |

## MISCELLANEOUS

| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Barytes, grd., white, bbl., ton. | $22.00-$25.00 | $22.00-$25.00 | $22.00-$25.00 |
| Casein, tech., bbl., lb. | .08- .11 | .08 - .11 | .12 - .13 |
| China clay, dom., f.o.b. mine, ton. | 8.00 -20.00 | 8.00 -20.00 | 8.00 -20.00 |
| Dry colors | | | |
| Carbon gas, black (wks.), lb. | .02¾ - .30 | .02¾ - .30 | .03 - .30 |
| Prussian blue, bbl., lb. | .36 - .37 | .36 - .37 | .37 - .38 |
| Ultramarine blue, bbl., lb. | .10 - .26 | .10 - .26 | .10 - .26 |
| Chrome green, bbl., lb. | .21 - .30 | .21 - .30 | .21 - .27 |
| Carmine red, tins, lb. | 4.00 - 4.40 | 4.00 - 4.40 | 4.00 - 4.40 |
| Para toner, lb. | .75 - .80 | .75 - .80 | .75 - .80 |
| Vermilion, English, bbl., lb. | 1.50 - 1.55 | 1.50 - 1.55 | 1.60 - 1.65 |
| Chrome yellow, C. P., bbl., lb. | .14½ - .15½ | .14½ - .15½ | .14½ - .15½ |
| Feldspar, No. 1 (f.o.b. N.C.), ton. | 6.50 - 7.50 | 6.50 - 7.50 | 6.50 - 7.50 |
| Graphite, Ceylon, lump, bbl., lb. | .06 - .06½ | .06 - .06½ | .06 - .06½ |
| Gum copal Congo, bags, lb. | .06 - .30 | .06 - .30 | .08 - .30 |
| Manila, bags, lb. | .07 - .14 | .07 - .14 | .09 - .14 |
| Damar, Batavia, cases, lb. | .16 - .24 | .16 - .24 | .15½ - .16 |
| Kauri cases, lb. | .17½ - .60 | .17½ - .60 | .19 - .25 |
| Kieselguhr (f.o.b. N. Y.), ton. | 50.00 -55.00 | 50.00 -55.00 | 50.00 -55.00 |
| Magnesite, calc, ton | 50.00 - ..... | 50.00 - ..... | 50.00 - ..... |
| Pumice stone, lump, bbl., lb. | .05 - .07 | .05 - .08 | .05 - .07 |
| Imported, casks, lb. | .03 - .04 | .03 - .04 | .03 - .04 |
| Rosin, H., bbl. | 5.75 - ..... | 6.55 - ..... | 6.40 - ..... |
| Turpentine, gal. | .27½ - ..... | .29 - ..... | .21 - ..... |
| Shellac, orange, fine, bags, lb. | .20 - ..... | .20 - ..... | .22 - ..... |
| Bleached, bonedry, bags, lb. | .19 - ..... | .19 - ..... | .17 - ..... |
| T. N. Bags, lb. | .10½ - ..... | .10½ - ..... | .12 - ..... |
| Soapstone (f.o.b. Vt.), bags, ton. | 10.00 -12.00 | 10.00 -12.00 | 10.00 -12.00 |
| Talc, 200 mesh (f.o.b. Vt.), ton. | 8.00 - 8.50 | 8.00 - 8.50 | 8.00 - 8.50 |
| 300 mesh (f.o.b. Ga.), ton. | 7.50 -10.00 | 7.50 -10.00 | 7.50 -11.00 |
| 225 mesh (f.o.b. N. Y.), ton. | 13.75 - ..... | 13.75 - ..... | 13.75 - ..... |

## INDUSTRIAL NOTES

FOOTE BROS. GEAR AND MACHINE CORP., Chicago, has appointed Murray-Baker-Frederick Co., 715 Linden Ave., Shrevesport, La., as district representative for Northern Louisiana and Southern Arkansas and Lloyd C. Taylor, Box 113, Richmond as representatives for Virginia.

THE OSBORN MFG. CO., Cleveland has purchased the assets of the Johns Conveyor Corp., Newark, N. J. Manufacturing operations are being moved to Cleveland and Harry S. Johns, their inventor, will be chief engineer of the Johns Conveyor Division of The Osborn Mfg. Co.

DOW CHEMICAL CO., Midland, Mich., has entered into an agreement which provides that for Dowtherm boilers purchased on or after May 23, 1938, rated at 1,000,000 B.to. per hr. capacity or more, or operating at 650 deg. F. or higher, the sale of Dowtherm shall be confined to units manufactured by the Foster, Wheeler Corp., New York.

MONSANTO CHEMICAL CO., St. Louis, has appointed James R. Turnbull sales promotion and advertising manager of the Plastics Division at Springfield, Mass.

UNION BOILER AND MFG. CO., Lebanon, Pa., has appointed as its eastern representative the Seamless Steel Equipment Corp., 39 Broadway, New York.

VICTOR CHEMICAL WORKS, Chicago, has enlarged its office space in the Board of Trade Bldg. The Company now occupies the entire 30th floor and part of the 31st floor.

TAYLOR INSTRUMENT COMPANIES, Rochester, N. Y., has elected Herbert J. Winn chairman of the board of directors. He is succeeded as president by Louis B. Swift, formerly vice-president in charge of engineering and research.

COMBUSTION ENGINEERING CO., INC., New York, has opened a branch office in Birmingtam, Ala., under the direction of J. B. Emory.

# New CONSTRUCTION

## PROPOSED WORK

**Chemical Fertilization Plant**—Rutley & Shepperd, London, England, c/o Louis Coderre, Deputy Minister, Dept. of Trade & Commerce, Quebec City, Que., are having plans prepared for the construction of a chemical fertilization plant at Quebec City. Estimated cost $75,000.

**Chemical Plant**—Pennsylvania Industrial Chemical Co., Inc., R. W. Ostermeyer, Pres., Clairton, Pa., plans to rebuild that portion of its chemical plant destroyed by fire recently with a loss of $250,000. Estimated cost will exceed $60,000.

**China Factory**—Royal China Co., Sebring, O., plans to construct a 2 story addition to its factory here. Estimated cost $50,000.

**Distillery**—Fraser's Distillery, Ltd., 510 West Hastings St., Vancouver, B. C., Can., is having plans prepared for the construction of a distillery in connection with brewery. Estimated cost $150,000.

**Distillery**—Glenmore Distillers, c/o Raymond Deateale, Gen. Sales Mgr., 660 South 4th St., Louisville, Ky., plan to rebuild their distillery recently destroyed by fire.

**Distillery** — Winnebago Distilling Co., c/o Paul Gerhardt, Archt., 447 Fullerton Ave., Chicago, Ill., plans to construct a distillery on State Route No. 25, South Elgin, Ill. Bids are now being received by the architect. Estimated cost $750,000.

**Factory**—Dominion Tar & Chemical Co., Ltd., 606 Cathcart St., Montreal, Que., Can., Lionel O. P. Walsh, Gen. Mgr., is having plans prepared for the construction of a factory at the MacMurray tar sands fields, Waterways, Alta., Can. Estimated cost $200,000.

**Factory**—National Gypsum Co., 190 Delaware Ave., Buffalo, N. Y., is having plans prepared by D. F. Hunt, Chief Engr., c/o Company, for an addition to its plant at East River and 148th St., New York, N. Y. Estimated cost will exceed $700,000.

**Factory**—Northam Warren Corporation, 191 Hudson St., New York, N. Y., has purchased a site on Ouimet Ave., St. Laurent, Que., Can., and plans to construct a factory for the manufacture of toilet preparations. Estimated cost $50,000.

**Oil Refinery**—Ben Schooler, Shawnee, Okla., plans to construct an oil refinery to have a capacity of 1,000 bbl. Estimated cost $50,000.

**Oil Refinery**—Zane Refining Co., c/o P. N. Faine, Secy., Ohio Penn Grade Oil Producers' Assn., Zanesville, O., plans to construct a modern 1500 bbl. crude oil refinery on a 40 acre site along the Muskingum River. Estimated cost $500,000.

**Paper Products Plant**—Hinde & Dauch Paper Co., 814 Stephenson Bldg., Detroit, Mich., plans to construct a 1 story, 200x510 ft. factory for the manufacture of paper boxes. Estimated cost $200,000.

### Where Plants Are Being Built in Process Industries

| | Current Projects | | Cumulative 1938 | |
|---|---|---|---|---|
| | Proposed Work | Contracts | Proposed Work | Contracts |
| New England | $55,000 | $40,000 | $395,000 | $1,219,000 |
| Middle Atlantic | 1,760,000 | 540,000 | 10,739,000 | 10,058,000 |
| South | 40,000 | 200,000 | 38,660,000 | 12,286,000 |
| Middle West | 1,500,000 | 380,000 | 15,602,000 | 6,232,000 |
| West of Mississippi | 50,000 | 5,950,000 | 19,847,000 | 7,855,000 |
| Far West | ..... | 137,000 | 1,335,000 | 3,320,000 |
| Canada | 475,000 | 50,000 | 23,719,000 | 50,000 |
| Total | $3,880,000 | $7,297,000 | $110,297,000 | $41,020,000 |

**Research Laboratories**—Department of Agriculture, Washington, D. C., plans to construct four regional research laboratories. Preliminary plans are now being drawn under the direction of D. J. Price, Chemical Eng. Div., Bureau of Chemistry & Soils, Wash., D. C. The exact location and character of the construction have not been announced. Estimated cost of building and equipment $1,000,000.

**Warehouse**—G & S Paper Co., 93 West Street, Newton, Mass., is having revised plans prepared by Clifford S. J. White, Archt., 199 Harvard Circle, Newton, Mass., for the construction of a 1 story, 74x171 ft. reinforced-concrete warehouse. Estimated cost $55,000.

## CONTRACTS AWARDED

**Factory**—West Coast Kalsomine Co., 5th and Grayson Sts., Berkeley, Calif., has awarded the contract for the construction of a factory to J. F. Tulloch, 335 Eighth St., Oakland, at $89,165. Contract price does not include equipment.

**Gas Pipe Line**—Carnegie Natural Gas Co., Frick Bldg., Pittsburgh, Pa., has awarded the contract for the construction of a 27 mi. solid welded 8 in. gas pipe line to connect Fayette Co. gas fields near Uniontown, Pa., with owners own line serving industrial consumers in Greater Pittsburgh area to Rich & Co., Bradford, Pa. Estimated cost between $400,000 and $500,000.

**Laboratory** — General Petroleum Co., Higgins Bldg., Los Angeles, Calif., will soon start work on the construction of a control laboratory building and a storage building at its refinery at Torrance, Calif. Estimated cost $45,000 and $3,000 respectively. Work will be done by owners.

**Laboratory**—Pitman-Moore Co., F. V. Hawkins, Secy., 1220 Madison Ave., Indianapolis, Ind., manufacturer of pharmaceutical products, has awarded the contract for a 5 story, 60x136 ft. laboratory to Carl M. Geupel Construction Co., 923 Hume Mausur Bldg., Indianapolis. Estimated cost $300,000.

**Newsprint Mill** — Southern Newspaper Publishers Assn., c/o J. G. Stahlman, Nashville, Tenn., has awarded the contract for the construction of a newsprint mill at Lufkin, Tex., to Merritt, Chapman & Scott, 17 Battery Pl., New York, N. Y. Estimated cost $3,750,000.

**Oil Refinery**—Continental Oil Co., Ponca City, Okla., has awarded the contract for enlargement of gasoline refinery, including installation of Cross cracking, thermal gasoline unit, additional boilers, cooling tower and refinery stills, to M. W. Kellogg Co., 225 Bway., New York, N. Y., $1,250,000. Rearrangement of steam equipment, new pumping equipment and installation of same, rebuilding the electrical distribution system and general remodeling of auxiliary equipment to cost $250,000 will be done by company forces.

**Oil Refinery**—Mid-West Refineries, Inc., C. L. Fillmore, Secy. & Treas., Alma, Mich., has awarded the contract for installation of a Dubbs cracking unit at its refinery to crack 1,000 bbl. per day and reform 200 bbl. a day of straight run gasoline to Frick-Reid Supply Corp., 117 Sandusky St., Pittsburgh, Pa. Unit will be designed by Universal Oil Products Co., Chicago, Ill. Estimated cost $40,000.

**Oil Refinery**—Ohio Oil Co., Robinson, Ill., plans to rebuild that portion of its oil refinery recently destroyed by fire. Work will be done by company forces. Estimated cost will exceed $40,000.

**Oil Refinery**—Socony Vacuum Oil Co., Inc., 1103 Elk St., Buffalo, N. Y., has awarded the contract for an addition to its refinery to C. S. Smith, 375 Plymouth Ave., Buffalo, N. Y. Estimated cost $40,000.

**Paper Mill**—Crossett-Watsek-Gates Industries, Inc., Crossett, Ark., has awarded the contract for additions to its paper mill to include power house and equipment to Rust Engineering Co., Clark Bldg., Pittsburgh, Pa. Estimated cost $700,000.

**Paper Mill**—Southern Kraft Corp., Mobile, Ala., plans to enlarge its paper and pulp mills at Mobile. Work will be done by company forces. Estimated cost $200,000.

**Rubber Factory**—Armstrong Rubber Co., Inc., 475 Elm St., New Haven, Conn., has awarded the contract for a 1 story, 80x220 ft. addition to its factory to Hewlett Construction Co., 1385 Iraniston Ave., Bridgeport, Conn. Estimated cost will exceed $40,000.

**Rubber Factory**—Sterling Rubber Co., Ltd., Guelph, Ont., Can., has awarded the contract for an addition to its plant on Waterloo St., Guelph, to Battaglia & Pagani, 120 Ferguson St., Guelph. Estimated cost $50,000.

# Chem. & Met.'s Weighted Index for Chemical Consumption

IN THE September issue, announcement was made of a new index for measuring consumption of chemicals. In that presentation, index numbers were published for the years 1932 through 1936 and monthly indexes were shown for 1937 forward. Because of the numerous requests for monthly indexes for the 1932–1936 period, we are publishing them so that figures may be available to those who are interested in carrying back monthly studies over the longer period.

| 1932 | Fertilizer | Pulp and Paper | Glass | Petroleum Refining | Paint, Varnish and Lacquer | Iron and Steel | Rayon | Textiles | Coal Products | Leather, Glue and Gelatine | Explosives | Rubber | Plastics | Index Number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. | 17.01 | 11.04 | 7.54 | 8.98 | 5.58 | 3.84 | 2.98 | 5.20 | 4.24 | 2.81 | 2.89 | 1.76 | .78 | 74.74 |
| Feb. | 16.09 | 9.92 | 7.30 | 8.34 | 5.72 | 3.88 | 2.83 | 5.48 | 4.04 | 3.22 | 2.66 | 1.86 | .92 | 72.26 |
| March | 13.39 | 11.13 | 6.57 | 8.94 | 6.72 | 4.25 | 2.63 | 5.81 | 4.23 | 3.40 | 2.73 | 1.75 | .81 | 72.36 |
| April | 11.57 | 11.23 | 7.12 | 9.28 | 7.94 | 3.63 | 2.00 | 4.31 | 3.81 | 3.10 | 2.77 | 1.55 | .67 | 68.98 |
| May | 6.81 | 10.98 | 6.39 | 9.75 | 8.80 | 3.10 | 1.65 | 3.88 | 3.53 | 2.74 | 2.48 | 1.67 | .53 | 62.31 |
| June | 4.87 | 8.99 | 7.30 | 9.46 | 6.87 | 2.66 | 1.58 | 3.94 | 3.12 | 2.71 | 2.31 | 2.18 | .51 | 56.50 |
| July | 5.52 | 7.12 | 5.08 | 9.34 | 5.15 | 2.42 | 2.41 | 3.51 | 3.09 | 2.69 | 2.30 | 1.63 | .33 | 50.59 |
| August | 8.93 | 7.59 | 3.64 | 8.79 | 5.65 | 2.54 | 4.45 | 5.17 | 3.00 | 3.29 | 2.81 | 1.27 | .48 | 57.61 |
| Sept. | 9.26 | 7.31 | 4.23 | 8.34 | 5.86 | 2.39 | 5.31 | 6.28 | 3.14 | 3.83 | 3.19 | 1.35 | .68 | 61.17 |
| Oct. | 11.86 | 8.33 | 5.43 | 8.72 | 5.51 | 2.70 | 4.84 | 6.32 | 3.53 | 3.73 | 3.47 | 1.33 | .73 | 66.50 |
| Nov. | 16.57 | 9.55 | 6.28 | 8.56 | 4.36 | 2.91 | 4.45 | 6.15 | 3.56 | 3.11 | 1.33 | 1.37 | .69 | 70.54 |
| Dec. | 17.78 | 8.87 | 5.48 | 8.62 | 3.36 | 2.88 | 4.35 | 5.42 | 3.63 | 2.69 | .73 | 1.10 | .55 | 67.41 |
| Year | 11.64 | 9.34 | 6.03 | 8.93 | 5.96 | 3.10 | 3.29 | 5.13 | 3.58 | 3.11 | 2.76 | 1.57 | .64 | 65.08 |
| 1933 | | | | | | | | | | | | | | |
| Jan. | 17.98 | 9.31 | 5.71 | 8.63 | 4.16 | 2.94 | 4.77 | 5.76 | 3.58 | 2.92 | 2.62 | 1.28 | .51 | 70.17 |
| Feb. | 14.93 | 8.54 | 5.86 | 7.97 | 4.30 | 2.68 | 4.02 | 5.38 | 3.19 | 3.40 | 2.42 | 1.19 | .48 | 64.36 |
| March | 13.42 | 10.06 | 6.25 | 8.88 | 5.00 | 3.17 | 2.89 | 5.60 | 3.24 | 3.19 | 2.35 | .99 | .42 | 65.46 |
| April | 12.58 | 10.60 | 6.48 | 8.98 | 7.03 | 2.63 | 5.15 | 5.53 | 3.19 | 3.25 | 2.36 | 1.41 | .50 | 69.69 |
| May | 13.97 | 12.55 | 7.86 | 9.70 | 9.66 | 4.01 | 6.78 | 7.68 | 3.43 | 3.68 | 2.41 | 2.38 | .79 | 84.90 |
| June | 10.31 | 12.12 | 9.64 | 9.74 | 10.24 | 5.71 | 6.34 | 8.68 | 4.04 | 3.99 | 2.98 | 2.78 | .88 | 87.45 |
| July | 13.02 | 11.23 | 9.88 | 10.38 | 8.13 | 6.11 | 6.50 | 7.53 | 5.20 | 4.19 | 3.49 | 2.28 | .92 | 88.95 |
| August | 20.78 | 11.14 | 10.02 | 10.33 | 7.57 | 6.51 | 5.77 | 7.37 | 5.47 | 4.13 | 3.66 | 2.55 | 1.18 | 96.47 |
| Sept. | 19.00 | 9.96 | 9.17 | 9.83 | 7.02 | 5.44 | 6.02 | 6.37 | 5.10 | 3.80 | 3.68 | 2.07 | 1.10 | 88.65 |
| Oct. | 25.34 | 11.22 | 7.86 | 9.85 | 6.91 | 5.35 | 5.33 | 6.45 | 4.82 | 3.72 | 3.66 | 1.87 | 1.09 | 93.47 |
| Nov. | 26.45 | 11.68 | 7.09 | 8.93 | 5.92 | 4.50 | 4.71 | 5.99 | 4.57 | 3.24 | 3.40 | 1.72 | .76 | 88.96 |
| Dec. | 25.53 | 11.19 | 6.70 | 9.19 | 5.88 | 4.47 | 4.39 | 4.46 | 4.80 | 2.96 | 3.44 | 1.75 | .73 | 85.49 |
| Year | 17.78 | 10.80 | 7.71 | 9.37 | 6.80 | 4.46 | 5.23 | 6.40 | 4.22 | 3.55 | 3.04 | 1.86 | .78 | 82.00 |
| 1934 | | | | | | | | | | | | | | |
| Jan. | 25.97 | 11.39 | 7.64 | 9.33 | 7.48 | 4.09 | 5.25 | 6.23 | 4.80 | 3.24 | 4.16 | 2.18 | .99 | 92.75 |
| Feb. | 23.46 | 10.34 | 7.39 | 8.67 | 6.42 | 4.20 | 5.50 | 5.96 | 4.84 | 3.98 | 3.73 | 2.22 | 1.23 | 87.94 |
| March | 22.60 | 11.99 | 8.80 | 9.37 | 8.28 | 5.72 | 4.64 | 6.49 | 5.66 | 4.02 | 4.05 | 2.64 | 1.40 | 95.66 |
| April | 18.42 | 11.64 | 8.30 | 9.60 | 10.08 | 6.70 | 4.03 | 6.03 | 5.84 | 4.12 | 3.93 | 2.63 | 1.43 | 92.75 |
| May | 13.43 | 12.27 | 8.62 | 9.95 | 12.26 | 8.14 | 4.15 | 6.16 | 5.92 | 3.93 | 3.53 | 2.42 | 1.14 | 91.92 |
| June | 12.22 | 10.84 | 8.15 | 9.92 | 10.46 | 7.27 | 4.70 | 4.50 | 5.66 | 3.52 | 3.62 | 2.28 | .82 | 83.96 |
| July | 11.78 | 9.82 | 7.45 | 10.44 | 8.53 | 6.70 | 4.84 | 4.45 | 4.40 | 3.57 | 3.41 | 1.83 | .78 | 78.00 |
| August | 12.17 | 10.73 | 8.79 | 10.41 | 8.83 | 6.01 | 4.54 | 5.03 | 4.23 | 3.88 | 3.81 | 1.78 | 1.02 | 81.23 |
| Sept. | 14.87 | 10.27 | 7.41 | 9.62 | 8.07 | 4.64 | 4.60 | 3.71 | 4.10 | 3.70 | 3.72 | 1.66 | .95 | 77.32 |
| Oct. | 21.17 | 11.86 | 8.64 | 9.92 | 8.81 | 4.36 | 5.80 | 6.29 | 4.35 | 3.39 | 3.92 | 1.76 | 1.20 | 91.47 |
| Nov. | 24.42 | 11.70 | 8.96 | 9.63 | 7.35 | 3.82 | 5.94 | 5.96 | 4.23 | 3.20 | 3.66 | 1.86 | .94 | 91.67 |
| Dec. | 26.37 | 11.00 | 8.37 | 9.98 | 5.94 | 3.51 | 7.09 | 5.43 | 4.55 | 3.24 | 3.30 | 1.98 | 1.18 | 91.94 |
| Year | 18.91 | 11.15 | 8.21 | 9.74 | 8.54 | 5.43 | 5.09 | 5.52 | 4.88 | 3.65 | 3.74 | 2.10 | 1.09 | 88.05 |
| 1935 | | | | | | | | | | | | | | |
| Jan. | 27.08 | 12.20 | 9.64 | 9.84 | 7.75 | 6.31 | 7.41 | 6.82 | 5.64 | 3.62 | 4.25 | 2.42 | 1.78 | 104.76 |
| Feb. | 22.38 | 11.60 | 9.38 | 9.22 | 7.89 | 6.44 | 5.74 | 6.01 | 5.61 | 3.95 | 3.80 | 2.24 | 1.72 | 95.98 |
| March | 19.48 | 12.68 | 10.15 | 9.98 | 9.86 | 6.91 | 3.70 | 6.09 | 5.86 | 4.09 | 2.71 | 2.23 | 1.69 | 95.43 |
| April | 16.06 | 12.48 | 10.64 | 9.92 | 12.20 | 6.96 | 3.92 | 5.79 | 5.36 | 4.04 | 3.38 | 2.31 | 1.75 | 94.81 |
| May | 13.41 | 12.52 | 10.65 | 10.48 | 13.44 | 6.64 | 5.51 | 6.09 | 5.63 | 3.81 | 3.31 | 2.17 | 1.45 | 95.11 |
| June | 13.37 | 11.71 | 10.18 | 10.66 | 12.00 | 6.00 | 5.87 | 5.28 | 5.29 | 3.64 | 3.24 | 1.90 | 1.04 | 90.18 |
| July | 16.14 | 11.68 | 10.16 | 11.07 | 10.75 | 6.89 | 6.50 | 5.35 | 5.02 | 3.80 | 3.23 | 1.88 | 1.12 | 93.59 |
| Aug. | 17.44 | 12.66 | 10.75 | 11.05 | 10.58 | 7.48 | 7.85 | 5.65 | 5.50 | 4.17 | 3.50 | 2.04 | 1.37 | 100.04 |
| Sept. | 17.89 | 12.27 | 10.31 | 10.87 | 10.60 | 7.60 | 8.45 | 6.16 | 5.72 | 4.21 | 4.08 | 1.96 | 1.77 | 101.89 |
| Oct. | 22.27 | 13.84 | 12.31 | 11.10 | 12.20 | 9.13 | 6.79 | 7.03 | 6.17 | 4.18 | 4.30 | 2.28 | 2.14 | 113.74 |
| Nov. | 22.80 | 13.02 | 11.56 | 10.86 | 9.45 | 7.83 | 6.57 | 6.60 | 6.28 | 4.14 | 3.92 | 2.28 | 1.86 | 107.17 |
| Dec. | 25.32 | 12.02 | 11.23 | 11.08 | 7.48 | 8.21 | 7.17 | 6.45 | 6.80 | 3.75 | 3.72 | 2.32 | 1.75 | 107.30 |
| Year | 19.47 | 12.39 | 10.58 | 10.51 | 10.35 | 7.20 | 6.29 | 6.11 | 5.74 | 3.95 | 3.62 | 2.17 | 1.62 | 100.00 |
| 1936 | | | | | | | | | | | | | | |
| Jan. | 23.79 | 13.34 | 11.53 | 11.20 | 8.01 | 6.05 | 6.40 | 7.50 | 6.66 | 3.93 | 4.17 | 2.57 | 1.65 | 106.80 |
| Feb. | 20.80 | 12.84 | 10.77 | 10.63 | 6.86 | 6.34 | 6.73 | 6.61 | 6.32 | 4.07 | 4.20 | 2.00 | 1.57 | 99.74 |
| March | 20.60 | 13.48 | 11.77 | 11.13 | 10.08 | 6.91 | 5.81 | 6.96 | 6.55 | 4.02 | 3.72 | 2.28 | 1.62 | 104.93 |
| April | 17.08 | 14.15 | 13.26 | 11.05 | 12.28 | 8.06 | 5.99 | 7.23 | 6.97 | 3.92 | 4.00 | 2.70 | 2.07 | 108.76 |
| May | 16.20 | 14.24 | 13.80 | 11.81 | 13.83 | 8.26 | 6.01 | 6.63 | 7.55 | 3.72 | 4.42 | 2.65 | 1.87 | 110.99 |
| June | 18.15 | 13.95 | 13.51 | 11.60 | 13.06 | 8.16 | 6.99 | 7.14 | 7.43 | 3.51 | 4.58 | 2.76 | 1.75 | 112.59 |
| July | 19.16 | 13.64 | 13.12 | 11.95 | 11.50 | 8.06 | 8.00 | 7.68 | 7.48 | 4.05 | 4.44 | 2.58 | 1.81 | 113.47 |
| August | 20.56 | 14.48 | 14.30 | 12.20 | 11.11 | 8.64 | 8.41 | 7.30 | 7.78 | 4.59 | 4.74 | 2.54 | 2.09 | 118.74 |
| Sept. | 23.47 | 14.50 | 13.69 | 11.85 | 11.24 | 7.97 | 7.49 | 7.95 | 7.70 | 4.67 | 4.97 | 2.56 | 2.26 | 120.32 |
| Oct. | 29.22 | 16.15 | 12.92 | 12.15 | 11.63 | 9.02 | 7.22 | 8.12 | 8.19 | 4.42 | 5.31 | 2.75 | 2.57 | 129.67 |
| Nov. | 30.51 | 15.12 | 11.19 | 11.62 | 9.69 | 9.31 | 7.53 | 7.50 | 8.14 | 4.01 | 5.55 | 2.77 | 2.28 | 125.22 |
| Dec. | 31.30 | 15.83 | 9.54 | 12.13 | 9.95 | 9.22 | 7.54 | 7.54 | 8.75 | 4.05 | 5.10 | 2.80 | 2.10 | 126.97 |
| Year | 23.57 | 14.31 | 12.45 | 11.61 | 10.77 | 8.00 | 7.01 | 7.44 | 7.46 | 4.08 | 4.60 | 2.58 | 1.97 | 114.85 |

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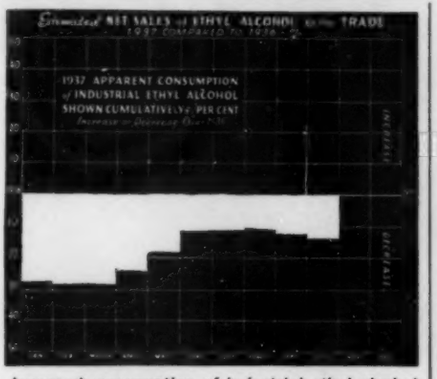
# SOLVENT NEWS

*Reg. U. S. Pat. Off.*

JANUARY ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1938




Apparent consumption of industrial ethyl alcohol from Jan. 1 to Oct. 31, 1937, was 49,742,000 wine gallons. This is 12.4 per cent less than during the same period in 1936 when 56,741,000 wine gallons were consumed.

## Makes Tacky Adhesive By Mixing Solutions of Rubber and Ester Gum

WASHINGTON, D. C.—Combining a solution of rubber with a solution of ester gum will produce an adhesive characterized by "permanent tackiness," according to a recent patent granted here.

If applied to one surface, the adhesive will join two surfaces in an essentially "permanent" bond which can be broken apart later without damaging or marring the surfaces, the inventor claims.

Typical formulations for the two solutions are cited by the patent as follows:

**Solution 1**

| | |
|---|---|
| Milled crepe rubber | 1 lb. |
| Naphtha | 2½ gals. |

**Solution 2**

| | |
|---|---|
| Ester gum | 4 lbs. |
| Toluol | 25.6 ozs. |
| Ethyl Acetate | 19.2 ozs. |
| Butyl Acetate | 6.4 ozs. |

To obtain an adhesive with the proper tackiness, the inventor adds preferably 5 to 15 ounces of the ester gum solution to sufficient rubber solution to make a total yield of about 1 gallon.

The resultant product can be used "for joining together in all combinations paper, cardboard, glass, wood, cork, metals, fabrics, cellophane, etc." Upon separation of any joined surfaces, all of the adhesive remains on the surface to which it was originally applied, the patentee asserts.

## Simplify Paint & Varnish Containers and Shades

"Consistent educational effort" toward familiarizing the industry and the consumer with the simplification program relating to shades and containers for paints, varnishes, and related products is urged upon all manufacturers by the joint committee on Simplified Practice Recommendation R 144-37 in a recent bulletin issued by the Dep't. of Commerce.

The bulletin outlines revisions and additions to the original schedule accepted by the industry and lists over 600 organizations now cooperating.

The committee stresses the value of previous work and asks for suggestions "to keep it abreast of current conditions."

## Explains How To Figure Paint and Varnish Cost

Speaking at the Industrial Sales Session of the National Paint, Varnish and Lacquer Assn. in Cincinnati, Wm. R. Sieplein, general supervisor of costs, The Sherwin-Williams Co., presented a cost system for paint and varnish manufacturers that is winning the acclaim of experts.

Mr. Sieplein reports that after the NRA was outlawed, much of the improvement brought about by the Cost Committee of the Code Authority was dissipated. Starting with the work of this and other committees, the author has developed a cost system which "clearly and simply outlines the fundamental principles."

Using many tables and charts, this expert cost accountant shows how to calculate the cost of raw materials, handling, manufacturing, labor, overhead, the formula yield and other factors which determine the final selling price.

Believing that many Solvent News readers would like to have copies of Mr. Sieplein's article, arrangements have been made to publish a comprehensive digest of it in the 4-page Solvent News folders mailed without charge to subscribers. To receive your copies, simply write to U.S.I. and ask that your name be added to the Solvent News mailing list.

### Silicon Carbide in Paints

Chemical resisting paint in which finely ground silicon carbide is added to the usual pigments was recently patented in England. The silicon carbide acts as a pigment and as a chemical resisting admixture, it is said. Titanium oxide can also be used, and small amounts of chrome pigments increase the rust-resisting properties, the patentee reports. Examples are given in which 85 parts of silicon carbide are added to 15 parts of litharge or red lead, or 85-75 parts of carbide to 15-25 parts of white lead.

**Complete specifications,** applications, commercial data and technical information on all the products of the U.S. Industrial Chemical Co., Inc., are given in the new catalog, "Solvents and Chemicals." Copies may be secured by writing to U.S.I. on your business letterhead and asking for a copy of the "Solvents and Chemicals" catalog.

## Find Ansol M Best Solvent in Resin Viscosities Study

### Develop Table for Manila Resin-Alcohol Solutions

BROOKLYN, N. Y.—Further evidence of the superiority of Ansol M as a resin solvent is contained in a report of a new series of tests on resin viscosities just completed in the laboratories of the American Gum Importers Association, Inc.

Twenty-eight grades of Manila were tested for their color, viscosity and solubility in various alcohols and denatured alcohol solvents. In every case Ansol M* showed the greatest solvent power and gave Manila resin solutions of lower viscosities than any denatured alcohol or alcohol-type solvent studied.

As a result of the tests resin consumers, it is pointed out, are for the first time able to prepare a Manila resin-alcohol solution of a given definite viscosity by consulting tables which show the viscosity of the resin in solvent.

### Pontianak Resin

At the same time, it is stated, the tables enable selection of the most satisfactory resin for a given viscosity on the basis of the viscosity ratings applied to each class of resin.

A simplified form of viscosity table for Pontianak resin follows:

| Grade | Ansol M* | Solox† | C.D. Alcohol No. 12 |
|---|---|---|---|
| Bold scraped | L | R | X |
| Mixed Bold | E | F | Q |
| Cuttings | I | J | O |
| Nubs | G | I | L |
| Chips | D | D | F |

The viscosities shown are Gardner-Holt viscometer readings in which viscosity is designated by letters. A indicates the least viscous solution; B one slightly more viscous, and so on.

As will be noted, an Ansol M* solution of Chips is the least viscous, while a C.D.

*(Continued on next page)*

**INTENSE INTEREST in the progress of the Chemical Industry during the past two years was shown by visitors to the Sixteenth Exposition of Chemical Industries held in New York last month. Approximately 4,000 people took special note of the U.S.I. display (above) where more than 100 products, many new, were shown. Dyestuff intermediates and special lacquer solvents prompted by far the greatest number of inquiries.**

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JANUARY ★ SOLVENT NEWS ★ 1938

## Stabilize Lacquer With Formaldehyde Solution

LONDON, England—How to stabilize in the can, lacquers of the urea formaldehyde and phenol formaldehyde type that harden by polymerization, is revealed in a recent patent granted here.

The inventor uses free formaldehyde—conveniently added to the lacquer in a solution of butyl alcohol.

A typical formulation outlined in the patent papers is as follows: To a 50 per cent solution of urea formaldehyde resin in butyl alcohol (40 parts) is added 2½ parts of paraformaldehyde dissolved in 5 parts of butyl alcohol (which may also contain the hardening catalyst) with the aid of a trace of alkali and 0.1 per cent of 30 per cent hydrochloric acid.

When so treated, the resultant lacquer, it is claimed, will dry to a hard, insoluble film in one to two hours.

### Chloroprene in '38 cars

Chloroprene rubber is being used for one or more purposes on most of the 1938 automobiles, according to "Automotive Industries." Among the applications reported are water pump seals, radiator cap gaskets, gear shift bumpers, dust and oil seals and as a bumper in the front wheel lower spring seat. The latter application utilizes both the vibration-dampening and oil-resisting properties of the synthetic rubber.

## *Metallic Soap Retards Chalking of Paint Film*

LONDON, England—Failure of paint film by chalking is noticeably delayed by compounding with certain metallic soaps, according to a new series of tests reported here. The soaps used, tin oleate, tin resinate and chromium oleate, were found to have a double action: delaying the onset of chalking and retarding it if already begun. An increase in the interval preceding chalking of 50 to 100 per cent was noted when a solution of chromium oleate in petroleum spirit was used. Since paints containing titanium dioxide were used in the tests, the experimenters believe that other paints will also respond to the treatment.

### Tobacco Treatment

LONDON, England—Treatment of tobacco leaves with ethylene gas to reduce curing time and improve flavor and aroma has been suggested by the Agricultural Adviser to the Colonial Office. Ethylene gas stimulates the enzyme action in the curing of tobacco, it is claimed.

**Sucrose octa-acetate** can be used for waterproofing textiles and for insulating paper and plaster substances, according to a recent article. The salt is dissolved in a suitable solvent and applied to the surface of textiles. Ironing is said to produce a completely waterproof gloss.

## Ansol M Wins Top Rating in Study of Resin Viscosities by Gum Ass'n

(*Continued from previous page*)

Alcohol No. 12 solution of Bold Scraped is the most viscous.

Experimental work has shown, when the range of materials covers all the commercial grades of Manilla Copal resins "that the superior solvent power of Ansol M* is maintained throughout."

The report further states:

"The superiority of Ansol M* as a solvent may be attributed to two factors:

"1. Ansol M* is . . . anhydrous . . . i.e., there is no water present. [Ansol M is substantially anhydrous denatured alcohol to which have been added percentages of ester and hydrocarbons—Ed.]

"2. The possibility of one of the denaturants in the Ansol M* being an excellent solvent for Manilas."

The tests were made by grinding the resin to split pea size or smaller, placing a 100 gram sample in a narrow screw cap jar and adding to this 100 grams of solvent. The jar was then rotated end over end, at about 30 R.P.M. for 15 to 18 hours at room temperature, after which it was allowed to stand for 24 hours. Color, viscosity and solubility determinations followed.

Among the Philippine and Pontianak resins examined, the best grade in each case gave the greatest viscosity. However, among the Lobas, Loba "A" gave a lower viscosity than Lobas "B," "C" and "D."

The Manilla Copals embrace those known as soft Manillas or Melengket, the half hard Lobas, the Pontianaks and the Boeas.

*Trade-mark registered by U.S. Industrial Chemical Co., Inc.
†U.S.I. proprietary solvent.

## TECHNICAL DEVELOPMENTS

*Further information on these items may be obtained by writing to U.S.I.*

**A sprayable corrosion-resistant plastic** has been developed to delay the damage to concrete, steel and wooden structures and equipment by corrosion, erosion, electrolysis, etc. According to the manufacturer, the material bonds to the base material and can be pigmented to practically any color or shade. **(No. 51)**

U S I

**A new heat-resisting aluminum finish** will withstand temperatures up to 1900 deg. F. without discoloration, blistering, etc., the manufacturer states. The material can be held over an open flame a few minutes after applying by brush or spray, it is claimed. **(No. 52)**

U S I

**Combination sheet aluminum and wood veneer** is now available for wall covering, paneling, etc. According to the manufacturer the aluminum gives light weight, fire-prevention and flexibility; the thin veneer of wood gives the beauty of natural grain in the color and texture desired. **(No. 53)**

U S I

**Loss of drying of paints on aging** is said practically to be eliminated by incorporating a small amount of a new product in the pigment before it is ground. **(No. 54)**

U S I

**A dispersion of carbon black in shellac** has been placed on the market. It is said to simplify the incorporation of carbon black into products where shellac is used. Reported composition is: shellac, 62½%, carbon black, 37½%. **(No. 55)**

U S I

**A waterproofing agent** for animal, vegetable and artificial fibers which is said to give a soft feel to the waterproofed fabric is now on the market. **(No. 56)**

U S I

**Calcium stearate beads** for waterproofing cement can be made more economically by a new process, according to a recent announcement. Other advantages claimed for the process are: Increased calcium stearate content (95.1 per cent), easier and more uniform dispersion with cement, and no dust from the beads. **(No. 57)**

U S I

**A rust preventive compound** which can be dipped, sprayed or brushed on metal surfaces to produce thin, transparent, colorless and corrosion-resisting films is now being marketed. According to the announcement, the films can be varied in texture, depending on the service desired. **(No. 58)**

U S I

**Perfection of a new-type "freeze-proof" carbon paper,** announced recently, is expected to overcome the reported "freezing" of carbon paper in the sales books of truck drivers, house-to-house canvassers and others operating out of doors during the winter. **(No. 59)**


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# SOLVENT NEWS

*Reg. U.S. Pat. Off.*

February ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1938

## Report Ethyl Cellulose Will Raise Viscosity Of Spirit Varnishes

BROOKLYN, N. Y.—Addition of ethyl cellulose is one of the most effective means of raising the viscosities of Pontianak spirit varnishes, according to recent experiments at the laboratories of the American Gum Importers Association, Inc.

Ethyl cellulose, it was found, not only produced greater viscosity per pound added than did other materials such as nitrocellulose or non-solvents for Pontianak, but had the additional advantage of solubility in alcohol or Solox,* one of the most widely used solvents in the spirit varnish field.

The tests were made with 5 pounds of Pontianak Nubs per gallon of Solox.* This varnish had a viscosity of E (on the Gardner-Holdt scale). By varying the amounts of ethyl cellulose added from zero to 0.4 pound per gallon of Solox* it was possible to produce a viscosity as high as Z4 (65 poises).

*Proprietary Solvent of the U. S. Industrial Alcohol Co. Leaflet on request.

## Claim New Adhesive Can Rebond Smooth Surfaces

WASHINGTON, D. C.—An adhesive which may be peeled from any smooth surface and then be re-affixed by pressure alone is revealed in a patent just granted here.

According to the patentee, a composition which has this property is obtained by combining cellulose nitrate with 65.3-71.5 volume per cent of castor oil and dissolving this in a suitable solvent which may be as follows: butyl acetate, 25 parts; butyl alcohol, 10 parts; ethyl alcohol, 5 parts; ethyl acetate, 10 parts; toluene, 50 parts.

## "Sunburn" Lacquered Skins To Make Better Patent Leather

BERLIN, Germany—First class "patent" leather can be produced by subjecting the lacquered skins to ultra-violet radiation for about two hours in a comparatively dry and ozone-free atmosphere, according to a report published here. The method given is to pass the skins, arranged on a suitable conveyor, at a rate of about 40 feet per hour under quartz lamps.

## Use Ethyl Alcohol to Dehydrate Leather In New Tanning Process

Ethyl alcohol is effective for dehydrating leather in a new tanning process reported in a recent issue of the Journal of Applied Chemistry. The pickled leather is dehydrated in a stream of alcohol, ether or acetone vapors at 50 deg. C., according to the article. Simultaneous dehydration and tanning are achieved, the author states, by passing formaldehyde vapors over the leather at 40 deg. C. for 4 hrs.

### To Hold Banquet on March 3rd

Over 1,800 chemists and executives of nearly every large chemical and drug organization are expected to attend the 1938 Drug, Chemical and Allied Trades Banquet at the Hotel Waldorf-Astoria, New York City, on Thursday, March 3rd.

## *See "Perfect" Lacquer In Inventor's 700th Patent*

MONTCLAIR, N. J.—Carleton Ellis, whose inventions range from dog biscuits to a substance for fireproofing airplanes against incendiary bullets, has received his 700th patent from the Patent Office, it was announced here recently. It is for a lacquer described as a step toward the "perfect paint."

Ellis obtains his lacquer by incorporating in a solvent like ethyl alcohol or acetone, syrupy or hard condensation products such as urea formaldehyde or derivatives of urea such as thiourea, the patent papers reveal. Special emphasis is placed on its applications as an impregnating material for tissue and glassine papers and for reducing the inflammability of nitrocellulose coatings or plastics.

**NEW U.S.I. CATALOG**

**Copies of U.S.I.'s new catalog of SOLVENTS AND CHEMICALS are now available. Complete specifications and applications of more than forty important products are covered. All requests for SOLVENTS AND CHEMICALS should be made on your letterhead.**

## Ethyl Formate Now Made by U.S.I.; Aids Organic Synthesis

### New U.S.I. Product Also Used As a Fumigant and Larvacide

With the addition of Ethyl Formate to products of its manufacture, the U. S. Industrial Chemical Co., Inc., has further expanded its line of chemicals derived from alcohol. Ethyl Formate is made by the esterification of formic acid with ethyl alcohol.

Although a number of uses have heretofore been made of Ethyl Formate, it became better known more recently as one of the basic organic substances employed in the commercial synthesis of crystalline vitamin $B_1$.

Another recognized application for Ethyl Formate is as a fumigant and larvacide for certain foodstuffs prior to packaging. Having the desirable characteristics of complete and rapid evaporation, as well as absence of residual taste and odor, it has been utilized for controlling the infestation of tobacco, dried fruits and other similar products.

#### In Vitamin $B_1$ Synthesis

The characteristic aroma of peach kernels has made Ethyl Formate of interest in compounding perfumes and flavoring bases.

Various sources name Ethyl Formate as an inhalant for treatment of certain respiratory inflammations. Other examples of its roles in

*(Continued on next page)*

FEMALE RAT, 24 WEEKS OLD
This rat above did not have enough vitamin B. The lack of muscle control is called spastic paralysis. The same rat below, 24 hours later, after having received a food rich in vitamin B. Already it has recovered muscle control.
MALE RAT, 28 WEEKS OLD
This rat had no vitamin G and weighed only 63 grams. Note loss of hair and emaciated condition. The same rat below, 6 weeks later, after receiving food rich in vitamin G, its weight was then 169 grams.

*Dept. of Commerce*

## New Vitamin B Data Indicates Importance of Balanced Diets

An important scientific news event of 1937 was the announcement that nicotinic acid had been identified as a member of the Vitamin B complex. This coupled with reports that the nicotinic acid itself had been used to make dramatic cures of human pellagra has focussed more sharply than ever before, the eyes of the scientific world on the role of Vitamin B complex in the human dietary.

The photo above illustrates some of the effects of Vitamin B complex deficiency in rats and the improvement which can be accomplished by proper diet.

Feeling that a review of recent progress in this field is of more than general interest, U.S.I. is publishing this month in its companion publication ALCOHOL NEWS an article on Vitamin B complex and its relation to human and animal nutrition. Copies of ALCOHOL NEWS containing this article may be secured by writing to U.S.I.

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## Masks Paint Odors By Adding Combination of Aromatic Substances

BALTIMORE, Md.—An entirely new approach to the problem of masking paint odors is claimed in a patent recently granted to a chemist of this city.

The method described in the patent recognizes the fact that different components of paint have different drying speeds. For example, the thinner may dry in about 2 hours whereas the oil may take 48 hours.

To overcome this effect the inventor adds to the paint "an odor-masking composition made up of a number of odor-masking substances which are of progressive volatility and which volatilize at the same rate as the various odor-emitting phases of the paint."

For example, to mask the odors of a flat wall paint composed of pigment, spar varnish, heat-bodied linseed oil, mineral spirits and dryer, the inventor uses one part of the following fragrant composition to 1300 parts of the paint, by weight:

| | Parts by wt. |
|---|---|
| 1. Amyl butyrate | 6.0 |
| 2. Benzyl acetate | 21.6 |
| 3. Phenyl ethyl alcohol | 31.2 |
| 4. Citral | 5.6 |
| 5. Geraniol | 20.0 |
| 6. Phenyl acetic acid | 7.8 |
| 7. Coumarin crystals | 7.8 |
| | 100.0 |

According to the patent, "Ingredients 1, 2, 3, and 4 will volatize during the two hours it takes for the mineral spirits to evaporate. During this time, these ingredients will mask the odor of the mineral spirits and then disappear.

"When the oxidation odor is emitted, it will be masked by ingredients 5, 6, and 7. The geraniol is effective during the early hours of oxidation when the odors are most pungent. The fixatives have a faint sweet smell which will overcome the decreasing odors of the paint until 48 hours after the initial brushing, all odors will have completely disappeared. The odors of ingredients 5, 6, and 7 decrease in intensity at the same rate as the oxidation odor with the result that at the end of the 48-hour period, there will not be present any odor due either to the paint or the masking agent."

## *Shipments of Pyroxylin Textiles Increase in '37*

WASHINGTON, D. C.—Shipments of pyroxylin-coated textiles for the first eleven months of 1937 were valued at $21,513,417 as compared with $18,999,274 during the same period of 1936, according to Director William L. Austin, Bureau of the Census, Department of Commerce.

Apparently part of this increase in value is due to higher prices since the 1937 value was 113% of 1936 whereas shipments of light goods, '37 compared to '36, were 109% and of heavy goods 111%.

## Ethyl Formate Now Made By U.S.I.; Aids Synthesis

(*Continued from previous page*)

medicine include applications as a diuretic, an antiseptic, a rubefacient, and a hypnotic.

Probably one of the most promising adaptations of Ethyl Formate lies in the field of organic synthesis. To synthesize vitamin $B_1$, one manufacturer has adopted a method which starts with Ethyl Formate and ethyl beta-ethoxypropionate. The crude derivative of this reaction is converted by successive steps into the purified crystalline vitamin.

Certain other syntheses using Ethyl Formate employ the Claissen reaction. Because of the great reactivity of the keto and carboxy aldehydes produced, this reaction is seen as a stepping stone to further synthesis.

Some Ethyl Formate is used as an active solvent for cellulose esters and ethers where its hydrolysis in water is not a drawback. It is also soluble in most organic solvents.

Further information may be secured by writing to U.S.I.

### Varnishing Damp Surfaces

For varnishing damp surfaces it has been suggested that a small amount of water-soluble alcohol be added to the thinner of the varnish. The alcohol will unite with the moisture on the surface of the wood and disappear with the thinner, it is said.

**Two new oils,** from elderberry seeds and from elm tree seeds, have been extracted by the chemistry department of one of the leading universities. The elderberry seed oil, it is stated, dries in less time than is required for linseed oil. The oil from elm tree seeds is believed to be of use to soap manufacturers because of its fatty acid content.

## TECHNICAL DEVELOPMENTS

*Further information on these items may be obtained by writing to U.S.I.*

**Swelling, shrinking and checking of wood** can be prevented by dipping, brushing or spraying with a new liquid material, the manufacturer states. The liquid is colorless, has no offensive odor, and treated surfaces can be finished or painted in the usual manner, it is claimed. **(No. 61)**

U S I

**Double Refined Candelilla wax,** said to be a substitute for Carnauba Wax, is now on the market. The manufacturer states that tackiness, moisture and foreign matter is removed to such an extent in the refining process that the finished product is being used as a full, as well as partial substitute for Carnauba. **(No. 62)**

U S I

**In a new filter,** for chemical solutions which must not touch metal, all parts coming into contact with the liquid are made of a high grade of hard rubber, according to a recent description. **(No. 63)**

U S I

**A new paint** containing finely-divided metallic zinc in a weather-resistant vehicle is said to be suitable for both the primer and finishing coat on any metallic surface. The finished appearance is battleship gray and resists atmospheric attack so no overcoating is required, the manufacturer claims. **(No. 64)**

U S I

**Glass that transmits only ultra violet light** and is opaque to the visible portion of the spectrum is now available in commercial (blown) quality, according to a recent announcement. When used with an ultra violet source this black filter permits the manufacture of an inexpensive medium to determine fluorescence, it is claimed. **(No. 65)**

U S I

**A fabric-protecting material** introduced recently is said to impart a water-repelling, soft-handle finish that resists washing, boiling soap solutions and dry cleaning. The manufacturer states that the material can be applied to all types of fabrics but recommends it particularly for cotton and linen dyed with fast color or not dyed. **(No. 66)**

U S I

**Liquid flame proofing material** which can be mixed with paint or used directly on fabrics was reported recently. The material is said to be colorless and odorless. **(No. 67)**

U S I

**A new vegetable adhesive** has been developed for sealing the new types of Kraft containers and ordinary corrugated shipping cases. The adhesive can be kept for a considerable time without crusting over and it is not injurious to the skin or clothing, the manufacturer reports. **(No. 68)**

U S I

**For measuring the stiffness of sheet materials** such as paper, textiles, plastics, rubber, leather, etc. (and of wires, yarns, bristles, etc., by using special holders) a new "stiffness tester" is said to give numerical values for rigidity, yield points, elastic recovery and other measurable properties. **(No. 69)**


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# SOLVENT NEWS

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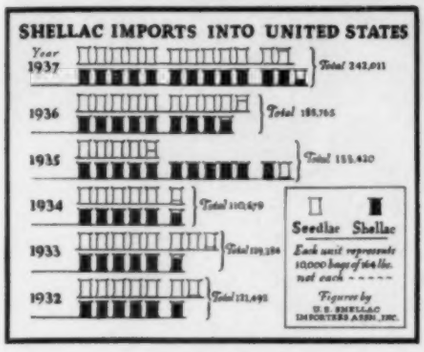
March ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1938




## U. S. Imports of Shellac Set 6-Year Peak in '37

NEW YORK, N. Y.—With imports of both shellac and seedlac making major gains, total shellac imports into the United States during 1937 reached the highest level in six years, data released by the U. S. Shellac Importers Association, Inc., reveals. Total imports were 242,011 bags (of 164 lbs. each), it is stated.

Imports of shellac rose to 122,939 bags, a gain of 42.6 per cent over 1936 imports of 88,563 bags. Imports of seedlac were 119,172 bags, 22.6 per cent greater than the 97,202 bags imported in 1936.

Forecasts indicate that while 1938 crops of Kusmi seedlac will be somewhat poorer, a good crop of Bysacky seedlac may be expected.

## Institute Report Points To New Uses for Shellac

NAMKUM, India—Experiments now in progress may open new uses for shellac, the annual report of the Indian Lac Research Institute indicates.

Impetus has been given the tests with the discovery that a condensation product of aleuritic acid, one of the major components of shellac, with phthalic anhydride and glycerine can be used to laminate safety glass. The product is said to be clear and flexible, with good adhesive properties for wood, hence the manufacture of plywood may be another application.

### Add Maleic Acid

Research on modification of shellac with organic acids is being continued, the report states. Incorporation of maleic acid with shellac varnish under certain conditions has yielded coatings with improved gloss, water resistance, elasticity, and adhesion to glass and metals, according to the Institute. Still better results are obtained when the coatings are baked for short periods at 120 to 130 deg. C., it is said. The improved coatings have been adapted to colored lacquers for electric bulbs and for tin and aluminum foils.

## New U.S.I. Division Managers

W. S. Wallace, formerly manager of U.S.I.'s Pittsburgh office, has been appointed manager of the U.S.I. office in Boston to succeed the late Victor L. Nickle.

W. W. Rule, formerly with U.S.I.'s Philadelphia office, has been appointed manager of the U.S.I. office in Pittsburgh to succeed W. S. Wallace.

Both appointments were effective Feb. 1.

# Expect New U.S.I. Process to Widen Range of Dyestuff Intermediates

### Compounds Derived From Acetanilid Are of High Purity; Found To be Suitable For Production of Azo Colors

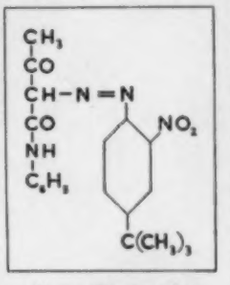
STAMFORD, Conn.—A new method for preparing certain useful derivatives of aniline has been realized here in the laboratories of the U. S. Industrial Alcohol Co. Three U. S. patents cover the process. The derivatives, although known as chemical compounds, have not been, it is believed, commercially available to chemical industry.

Compounds so far produced include para-tertiary-butyl-acetanilide, secondary butyl acetanilide, ortho-nitro-para-tertiary-butyl-acetanilide, tertiary butyl o-methyl acetanilide, isopropyl acetanilide and their corresponding amines.

### Other Applications

Important applications for the products lie in the dyestuffs field, although other uses are expected to unfold when the compounds become better known.

Among the amines, ortho-nitro-para-tertiary-butyl-aniline is expected to be used in the preparation of azo dyestuffs of the so-called "Hansa Yellow" group. Tests on these dyestuffs indicate that they have special properties of their own, one of which, is for example, great fastness to light. The formula for a yellow azo dyestuff prepared by coupling diazotized ortho - nitro - para-tertiary-butyl-aniline with aceto-acetanilid is illustrated.




**New yellow azo dyestuff (patented).**

Compounds produced from para-tertiary-butyl-aniline (whose applications are similar to those of para-toluidine) also have specific properties of their own.

Development of the process for production of these intermediates was an outgrowth of the discovery that the well-known Friedel-Crafts reaction could be applied successfully to acylated aniline or other acylated aromatic amines with alkyl halides or alkyl hydroxides.

Chief advantage of the process employed by U.S.I. over older methods for the production

(*Continued on next page*)

## V. L. Nickle Dies; Boston Manager Eleven Years

Victor L. Nickle, manager of U.S.I.'s Boston office since 1927, died on January 28th, after an illness of two weeks. Only 42 years old, his passing came as a distinct shock to his many friends.

**Victor L. Nickle**

In the fifteen years he had been with the U. S. Industrial Alcohol Co. "Nick" rose through the ranks, winning innumerable friends and the responsibility for the entire New England Territory.

Graduating as a chemical engineer from Pennsylvania State College in 1918, Mr. Nickle began his career in the dye, explosives and artificial leather industries. He joined the U.S.I. Chicago office in 1923 and two years later was attached to the Pittsburgh division.

Mr. Nickle was a member of the University Club, Boston, and was long active in its social and athletic life.

## New Lacquer Raw Material

BERLIN, Germany—A new lacquer raw material to emerge from German laboratories is Filax oil, believed to be a mixture of "unsaturated hydrocarbons and esters of monocarboxylic acids of these hydrocarbons in which the acid and alcohol components remain unsaturated."

The oil is said to be soluble in petroleum thinner, ketones, esters and higher alcohols; miscible in all proportions with linseed, perilla and oiticica oils; and unusually stable to cooking.

## Apply Anti-icing "Paint" To Airplanes, Pipes, Etc.

NEW YORK, N. Y.—What is believed to be the first successful anti-icing "paint" was recently introduced into this country from England. While the product was originally developed for refrigerator pipes, the manufacturers now visualize many other applications which may overshadow this use.

American airlines are understood to be considerably interested in the compound following a report from the Consulate General in London that Imperial Airways are using it with success. After a recent trans-Atlantic flight, the commander of the 'Cambria' is quoted as saying that despite two hours of blinding rain, sufficient material remained to be effective.

The report of another experiment states that while a wireless aerial, not coated, broke under the weight of the ice; another aerial, which had been coated, was in no way impaired.

The actual composition of the product is shrouded in mystery by both the manufacturers and their American representatives. It is known, however, that it is available in paste and liquid form.

### Use in Refrigeration

When used in cold storage plants, the material is said to permit easy defrosting without drip. It is also said to prevent damage to pipes or interruption of refrigeration and to prevent floors from icing up. As a result, floors are kept clean and valves, spindles, cocks, etc., in working order.

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MARCH ★ SOLVENT NEWS ★ 1938

## U.S.I.'s Ansol PR Aids In Determination of Dust Content of Air

*Special to* SOLVENT NEWS

PITTSBURGH, Pa.—Dust count determinations at a large industrial plant in this city are now being made with the aid of Ansol PR, a special solvent produced by the U. S. Industrial Chemical Co., Inc.

A certain volume of the air to be examined is drawn into a tube and impinged upon a plate immersed in Ansol PR. While the actual impingement takes place in air (because of the force of the jet) the dust particles are carried into the Ansol PR where they are captured and then counted.

Heretofore, double-distilled water was used in place of the Ansol PR but, according to a well-known industrial hygienist, the latter is more desirable because certain dust particles are soluble in water.

## Expect Process to Widen Range of Intermediates

(*Continued from previous page*)

of alkyl derivatives of aniline lies in the fact that the end products are of high purity and excellent yield. As contrasted with the ordinary method of preparing, for example, para-toluidine by nitration of toluol and laborious separation of isomers, the preparation of para-tertiary-butyl-acetanilide is relatively simple.

**Uses Ethylene Dichloride**

Acetanilid is suspended in an inert diluent such as ethylene dichloride (which prevents the reaction from proceeding at too rapid a rate) to which is later added anhydrous aluminum chloride. This reaction mixture is kept initially at a temperature below 50 deg. C. until nearly all the aluminum chloride is dissolved.

At this point, the mixture is cooled to —10 deg. C. and tertiary butyl chloride added. Then, the temperature is maintained at —5 deg. C. until the reaction ceases (after about 30 minutes).

The intermediate formed of aluminum chloride and the organic compound is decomposed with finely chopped ice, which results in separation of para-tertiary-butyl-acetanilide as a "doughy" mass. By washing this product with water and removing ethylene dichloride by boiling or steam distillation, crystalline para-tertiary-butyl-acetanilide is obtained.

In place of tertiary butyl chloride, tertiary butyl alcohol may also be used. Secondary butyl acetanilide and isopropyl acetanilids are obtained in much the same manner by employing the corresponding alkyl chlorides. For the manufacture of tertiary butyl o-methyl acetanilid, acetyl-o-toluidine is used in place of acetanilid.

Amines are obtained by deacylation of the foregoing products. Ortho-nitro-para-tertiary-butyl acetanilide is prepared by nitration of para-tertiary-butyl-acetanilide. Deacetylation of this product gives ortho-nitro-para-tertiary-butyl-aniline.

## *Solox Cleans Porcelain Plates in Transformers*

A large Mid-Western electrical company is now using Solox, U.S.I.'s general alcohol type solvent, for cleaning the porcelain plates in transformer boxes. Ordinary alcohol, they state, leaves an oily film and could not be used for this purpose since the terminals must be free from grease and dirt. Solox does a clean, quick job, it is said. Many other uses for this solvent are outlined in the "Solox Leaflet" which may be secured from U.S.I.

## Ultra-violet Modifies Shades of Dyed Rayon

WASHINGTON, D. C.—Ultra-violet rays will cause rayon threads to dye a lighter shade than non-irradiated threads, it is revealed in a patent granted here. Depending on the time the threads are irradiated and the design in which they are woven, a variety of dyed color effects can be obtained, it is reported.

**Cross-dyed Effects**

Applying this phenomenon the inventor produces fabrics with "cross-dyed" or two-color effects by knitting or weaving irradiated threads with untreated threads. After the fabric is dyed in the usual bath it has designs of different shades, the treated yarns being lighter than the others.

One of the advantages claimed for the process is that cross-dyed fabrics can be woven with thread of only one material rather than two as heretofore.

## TECHNICAL DEVELOPMENTS

*Further information on these items may be obtained by writing to U.S.I.*

**A new synthetic resin** emulsion paint is said to be reducible with water yet to dry waterproof in approximately 40 minutes and washable in 24 hours. The new paint is similar to casein paint but due to its resin base, is odorless and more washable and durable, the manufacturer states. **(No. 71)**

USI

**Penetrating agents** reported to be rapid-acting and adaptable to many industries where higher cost sulfonates are uneconomical are available. Typical applications include de-inking paper and various wetting-out operations in the manufacture of textiles, leather, metal cleaning compounds, sprays, etc. **(No. 72)**

USI

**A new film applicator** is claimed to be extremely accurate for producing, uniformly and quickly, films of predetermined thickness from paints, varnishes, lacquers or inks, irrespective of comparative viscosity. It is easy to operate or clean, according to the manufacturer. **(No. 73)**

USI

**A special clear lacquer** now on the market is not affected by any of the commonly used rust inhibitors and also resists humidity, salt spray, 10 per cent hydrochloric acid and other chemicals, the manufacturer reports. It can be applied to aluminum, brass, copper and other metals, the announcement continues, and will stand up well under stamping and forming. **(No. 74)**

USI

**Paint adherence** to paint-spray booths is said to be eliminated with a new soap solution in the form of a thick paste. The material is applied to the walls before spraying and may be easily removed with a hose, it is reported. **(No. 75)**

USI

**Etching solutions,** recently introduced, may be used to produce varied frosted effects on glass, or black color on brass, copper and silver, it is claimed. Application by rubber stamp yields quick results, according to the manufacturer. **(No. 76)**

USI

**A new spirit enamel coating** is claimed to have an unusually fast rate of drying. Other advantages, the manufacturers state, are higher gloss and harder finish, as compared with shellac. **(No. 77)**

USI

**Wrapping paper** which embodies the toughness of parchment when wet, and is also absorbent, has been introduced, according to a recent report. It can be immersed and agitated in water, washed with soap, or even boiled without disintegration, according to the manufacturer. **(No. 78)**

USI

**All the equipment necessary to make electric eye actuators** for such devices as smoke alarms, fire alarms, door signals, controls for electric signs, etc., is contained in a kit recently placed on the market, according to the manufacturer. **(No. 79)**

USI

**Rubber glazing putty,** now on the market, is said to cling tightly to both metal and glass and not to embrittle with age. The manufacturer also states that it is resistant to salt water. **(No. 80)**


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Anhydrous Denatured
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C.P. 96%—Pure and Denatured
Pure (190 Proof)—Taxpaid, Tax Free

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# SOLVENT NEWS

*Reg. U. S. Pat. Off.*

April ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1938

## Improves Lacquer By Heating Tung Oil In Presence of Sulphur

WASHINGTON, D. C.—Conversion of tung oil into a non-drying oil capable of imparting outstanding properties to nitrocellulose lacquers and compatible with common lacquer solvents, plasticizers and resins, is claimed in a patent issued here.

The preparation of the tung oil involves heating between 250 and 400 deg. C. in the presence of a small amount of sulphur or selenium (or mixtures of the two). The temperature and heating period are varied depending on the type of tung oil used.

Following the heat treatment, air is blown through the oil for about 15 minutes. As a result of the sulphur treatment, the inventors claim, the drying properties of the oil do not reappear during the blowing process.

A typical lacquer formulated with a substantial proportion of the processed oil can, they explain, be applied over an old lacquer coating without lifting or wrinkling.

## Alcohol-Gum Solution Stops Printing Offset Without Use of Heat

WASHINGTON, D. C.—In a new method for preventing offset in printing, an alcoholic solution of gum arabic is sprayed over the sheets as they emerge from the press, according to a recent patent.

Many printers now spray a "molten" material which solidifies at room temperature. The patent claims that "by changing the sprayed liquid to solid particles by drying instead of congealing, it is possible to avoid . . . providing heat . . . which is troublesome and objectionable in connection with a printing press."

A typical composition which permits the use of a fine spray and yields minute particles is given as 15 parts of U.S.P. gum arabic, 45 parts of water and 40 parts of alcohol.

Adding one part of gum tragacanth, the patent continues, "increases the viscosity and surface tension of the liquid and consequently increases the size of the drops and dried particles. . . . Other natural or synthetic gums having the characteristics of gum arabic . . . may be substituted."

## Shellac Imports Lag In First Two Months of '38

Total imports of shellac and seedlac during the first two months of 1938 was far behind the same months of 1937, figures released by the Shellac Importers Ass'n. reveal. Only 29,170 bags (each 164 lbs. net) were imported during January and February, 1938, while 47,106 bags were brought in during the first and second months of 1937.

The statistics also show that the imports of seedlac dropped more rapidly than shellac. In the 1937 period, shellac represented 44.5 per cent of the total imports, while in 1938 it represented 58.3 per cent.

### J. L. Rivet Succeeds Pfeifer

J. L. Rivet, well known to alcohol buyers in the Southern territory where he has served for many years, was appointed manager of the New Orleans division effective March 1st. Mr. Rivet succeeds Leon Pfeifer who retired.

Leon Pfeifer

## Leon Pfeifer Retires; U.S.I. Manager 18 Years

NEW ORLEANS, La.—Leon Pfeifer, manager of U.S.I.'s New Orleans sales division since 1920, retired on March 1 under the U.S.I. retirement plan.

With headquarters at New Orleans, Leon was well known as a result of his long and active record in the industrial alcohol industry. He held a number of responsible positions over a period of 33 years, during which he did much to promote the use of industrial alcohol.

He served as secretary and treasurer of the International Distilling Co. in 1903. Subsequently, he became president of the U. S. Industrial Alcohol Co. of Louisiana. In this post and other ones he carried forward the fight to have industrial alcohol plants enjoy the same privileges granted other industrial units.

In later years he was vice-president of the International Distilling Co. and the Louisiana Distilling Co., U.S.I. subsidiaries, until their transfer to the U. S. Industrial Alcohol Co. of W. Va. in 1917.

### Multi-colored Plastics

Plastics of contrasting colors are now being produced in a single molding operation, according to a recent report. The new process, it is claimed, enables the production of phenolic and urea molding combinations with a predetermined surface design.

## Predict More Uses for Improved Hansa Yellows

### Expert Calls Them "Tomorrow's Common Colors"; U.S.I. Pioneers Production of Intermediates

Because the trend is toward greater light-fastness and brilliance of shade, a vastly larger field is predicted for Hansa Yellows, according to a leading authority writing in a recent issue of the "American Ink Maker." In fact, he declares, they are probably tomorrow's common colors. U.S.I. feels that its pioneering in the development of intermediates for these colors has done much to further this trend.

With the production of acetoacetanilid, one of the most vital intermediates, real progress was made. In succeeding years U.S.I. chemists developed a domestic supply of another intermediate, acetoacet-o-chlor-anilid.

#### Acetoacet-o-toluidid Now Available

A more recent development resulted in the addition of acetoacet-ortho-toluidid. Similar in many of its properties to the other aceto-acetarylamides, acetoacet-ortho-toluidid is expected to expand manufacture of a wider range of Hansa yellow shades.

Like acetoacetanilid and acetoacet-o-chlor-anilid, it may be coupled with diazotised meta-nitro-para-toluidine, para-chlor-o-nitraniline or similar products to give a variety of yellows.

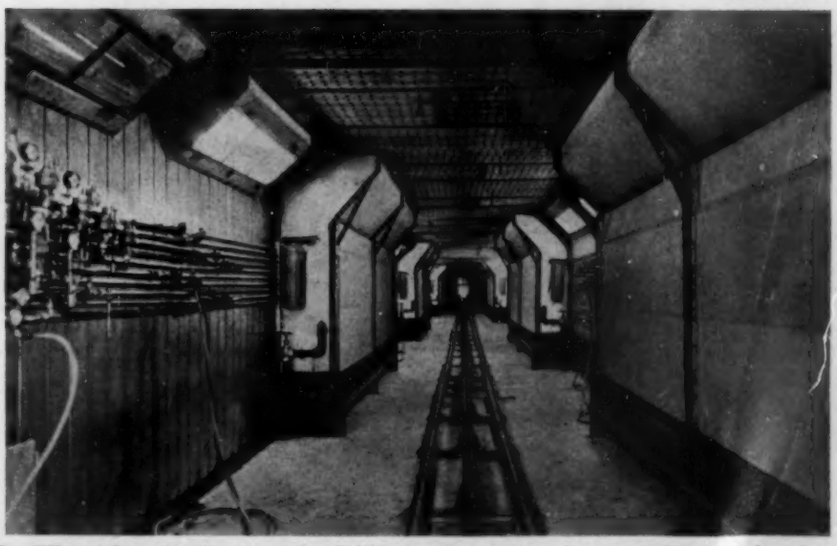
#### Pure Intermediates Essential

Some of the more common shades are Hansa G, 3G, 5G and 10G (See Jan., 1936, *Solvent News*). But these do not exhaust the possibilities, since the skill of the color maker and variation of conditions will permit other modifications.

Color makers, however, emphasize that purity of the essential intermediates is of paramount importance. Sponsored by long experience in the manufacture of other dyestuff intermediates, diethyl oxalate, ethyl

*(Continued on next page)*

## Tunnel Spray Booths for Continuous Automobile Painting



**For different from the time-consuming finishing methods that used to require 20 to 30 days for a good job, is this painting production line in a Detroit, Mich., auto plant. It consists of six down-draft hydro-filter spray booths in one continuous conveyor line. Filtered air enters through the perforated ceiling and fumes are carried off through vents near the floor.** *Courtesy B. O. Mahon Co.*

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## Prepare Pliable Resin By Esterifying Copal Gum With Butyric Acid

BRUSSELS, Belgium — Butyro-copal, an esterification product of copal resin, similar to aceto-copal but more easily prepared, is described in a recent report published here.

The ester is a resinous, pliable and elastic material with a softening point near 70 deg. C., an acid number of 139, a saponification value of 255 and an iodine number of 97.8. Because it is easily soluble in such solvents as ether, isobutyl alcohol, amyl alcohol, ethyl alcohol and trichlorethylene, the modified resin is expected to have many of the practical applications of aceto-copal, the report states.

The method of preparation cited for butyro-copal depends upon the refluxing of 100 parts of lump congo with 50 parts of technical butyric acid for several hours. The excess butyric acid is distilled off.

## Uses Dibutyl Phthalate To Stabilize Lubricant

ELIZABETH, N. J. — Dibutyl phthalate, properly thickened with polyvinyl acetate or other suitable thickening agents, can be used satisfactorily as a lubricant "capable of withstanding high temperatures without carbonization and possessing good lubricating and viscosity characteristics," it is revealed in a patent granted to an inventor of this city.

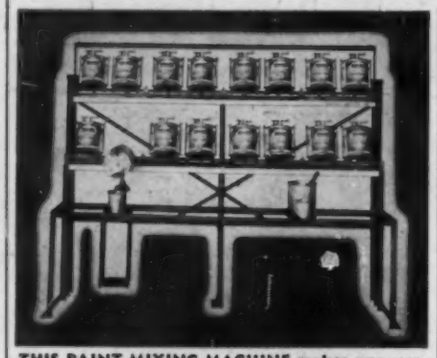
Combination of the thickened dibutyl phthalate with a mineral lubricating oil and with suitable soap ingredients yields a wide variety of lubricants, ranging from fairly viscous oils to greases, it is claimed.

The wide range of properties obtained with polyvinyl acetate is shown by the inventor in a table, which is abstracted below.

A suitable blend for a lubricating oil cited in the patent papers is:

| | |
|---|---|
| Coastal Mineral Oil | 80% |
| Dibutyl phthalate | 15 |
| Polyvinyl acetate | 5 |
| [**Dibutyl phthalate has been manufactured by U.S.I. for many years.**] | 100% |

| | Saybolt vis./100 | Saybolt vis./210 | Viscosity index | Flash F. | Pour F. | Conradson carbon % |
|---|---|---|---|---|---|---|
| N-dibutyl phthalate | 57.5 | 34 | .. | 310 | —50 | .003 |
| Thickened with: | | | | | | |
| 5% polyvinyl acetate (Sample A) | 304 | 65 | 144 | .. | .. | .. |
| 10% polyvinyl acetate (Sample A) | 995 | 139 | 134 | 315 | —30 | 1.837 |
| 20% polyvinyl acetate (Sample B) | 21,600 | 1,692 | 124 | .. | 15 | .. |
| 2.5% ethyl cellulose (medium viscosity | 963 | 80 | 79 | .. | .. | .. |
| 5% ethyl cellulose (high viscosity) | 7,596 | 276 | 89 | .. | 5 | .. |
| 5% benzyl cellulose | 609 | 68 | 92 | 330 | —20 | .. |
| 5% nitro cellulose | 675 | 83 | 118 | .. | .. | .. |
| 30% thickened linseed oil (thickened 18 hr.) | 864 | 178 | 143 | .. | .. | .. |
| 2% resin from polymerized diolefines | 189 | 50 | 136 | .. | .. | .. |
| 10% glycerol phthalate resin | 84 | 37 | .. | .. | .. | .. |



**THIS PAINT MIXING MACHINE makes unnecessary an inventory of hundreds of shades since, from 16 base tinting colors a large number of shades can be mixed, the manufacturer states. The equipment consists of 16 one-gallon cans each having a cast lid with an inbuilt agitator; a mixing can on a sliding tray; four gauges and a master formula book.**

## Predict More Uses For Improved Hansa Yellows

*(Continued from previous page)*

acetoacetate, sodium ethyl oxalacetate, etc., U.S.I. chemists have been able to maintain production of Hansa Yellow intermediates within very narrow specifications.

## TECHNICAL DEVELOPMENTS

*Further information on these items may be obtained by writing to U.S.I.*

**Mildew-proof mill white paint** said to contain a non-yellowing fungicide which kills the parasitic spores yet does not affect the brushing or smoothness of the finished film, was announced recently. According to the manufacturers, the paint is particularly suited to plants operating under high temperatures and humidity. **(No. 81)**

U S I

**An adhesive for bonding metal to wood** or glass, and synthetic plastic materials to almost any non-porous material has been introduced. It has been used successfully for fastening metal printing plates to wood or metal bases without nailing, according to the manufacturer. **(No. 82)**

U S I

**Rust solvents** designed for removing severe corrosion without any metal loss or with extreme etching action were recently announced. Five broad types, each composed of different acid and solvent combinations and strengths are available, it is said. **(No. 83)**

U S I

**A new emulsifying and dispersing agent** for water paints is said to have the following advantages, among others: Uniform dispersion of pigments, fillers and oil or resin. Better and more permanent paint film. Greater resistance to washing. Smoother surface. Low cost. **(No. 84)**

U S I

**A new paint deodorant** is described as a "compound of pure aromatic chemicals and essential oils which imparts a definite and permanent odor-neutralizing effect." It is said to dissolve readily in all paint mixtures in the recommended proportions of one pound of deodorant to 2,800 pounds of the average paint mixture. **(No. 85)**

U S I

**A special grade of Japan oil** for mixing house paints or undercoaters is claimed to minimize penetration by the oils of the paint so that the paint film dries stronger and more resistant to checking, cracking and scaling. The product is said to be especially valuable in paints for covering absorbent wood surfaces. **(No. 86)**

U S I

**A wetting and dispersing agent,** said to be particularly effective where resistance to formation of insoluble soaps or stability to acid or alkali is a requisite, has been introduced. The product, it is claimed, will disperse carbon black sufficiently well to pass through filter paper. **(No. 87)**

U S I

**A new adhesive** in paste form, said to bond paper to water-proofed fabrics, is now available. It will also make labels adhere to cans and paper to waxed surfaces, according to the manufacturer. **(No. 88)**

U S I

**Gold ink** which will not dry out on the rollers and plates of printing presses but which will dry speedily and without offset on the paper stock, was introduced recently. The ink is packed in a duplex can; the varnish in one section and the bronze powder in the other. **(No. 89)**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# SOLVENT NEWS

*Reg. U. S. Pat. Off.*

May ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1938

# U.S.I. ENTERS RESIN FIELD

## Acquires The Business Formerly Conducted By Robert Rauh, Inc.

### Synthetic Resins — Phenolics, Alkyds, Ureas — and Ester Gums Are Recognized as Logical Additions to Present U.S.I. Line

As part of its general program of expansion in the chemical field, the U. S. Industrial Alcohol Co. as of May 1, 1938 took over the business formerly conducted by Robert Rauh, Inc., well-known manufacturer of synthetic resins.

Robert Rauh, Inc., occupied a large, modern plant at Newark, N. J., where it specialized in the manufacture of a diversified line of resins, including alkyds, phenolics, ureas, ester gum, and copal esters. Well equipped laboratories were maintained for development work on new resins and on new uses for these products. All these facilities will be continued and expanded under the new ownership.

**Similar Outlets**

Among the principal industries served by Robert Rauh were the paint, varnish, lacquer, printing ink, linoleum, adhesives, plastics, composition floor tile, and insulating materials fields. Because these outlets are substantially those now using solvents and chemicals of the type manufactured by U.S.I., it is obvious that resins form a logical addition to this line, and place the company in a better position to serve the needs of its trade.

Expansion of the Rauh company has kept continually abreast of growth of the synthetic resin field. While the company has occupied its present plant since 1930, its history goes back to 1849 when David Rauh founded the firm abroad to make brewer's pitch. About 1912 the business was transferred to this country and a plant was opened in Newark, N. J. With the advent of Prohibition the market for brewer's pitch was curtailed and

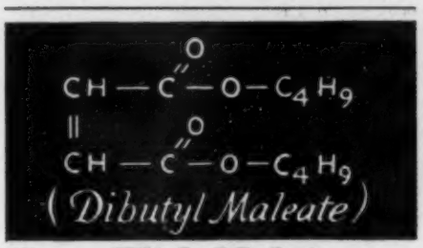
*(Continued on next page)*

### *Important Notice*

**Restatement of Policy**

*The reputation of a company is based not only upon the quality of its products and the character of its services, but also upon the soundness of its policies.*

*Coincident with the announcement of its entrance into the synthetic resin field, it will be of interest to the paint and varnish industry as well as to the lacquer industry for U.S.I. to reiterate its intention to continue as a manufacturer of raw materials for the trade and to refrain from producing finished products in competition with its customers.*




## Tests With Maleic Acid Esters Indicate Use In Synthesis

### Dimethyl, Diethyl, Dibutyl Maleates Recently Introduced by U.S.I.

NEW YORK, N. Y.—Experiments indicate that three new U.S.I. products — Dimethyl Maleate, Diethyl Maleate and Dibutyl Maleate —may be of value both as solvents and as intermediates for chemical synthesis.

These maleic acid esters are now available in limited quantities from small scale operation. Samples may be secured for experimental investigation.

**Acid Is Unsaturated**

Possibilities for the three esters in the field spring from the fact that their maleic acid component is of an unsaturated nature. Because of the presence of a double bond, it can be inferred that the esters are capable of undergoing the reactions characteristic of other unsaturated compounds such as addition, reduction, oxidation and polymerization. It is known, in addition, that maleates, being optical isomers, go over into fumarates under certain conditions and vice versa.

Laboratory tests demonstrate that Dibutyl Maleate has interesting properties as a solvent. The most outstanding of these is its low vapor pressure, which indicates that it may have possibilities as a solvent-plasticizer. The boiling point of Dibutyl Maleate is 123° C. at 3 mm. absolute pressure.

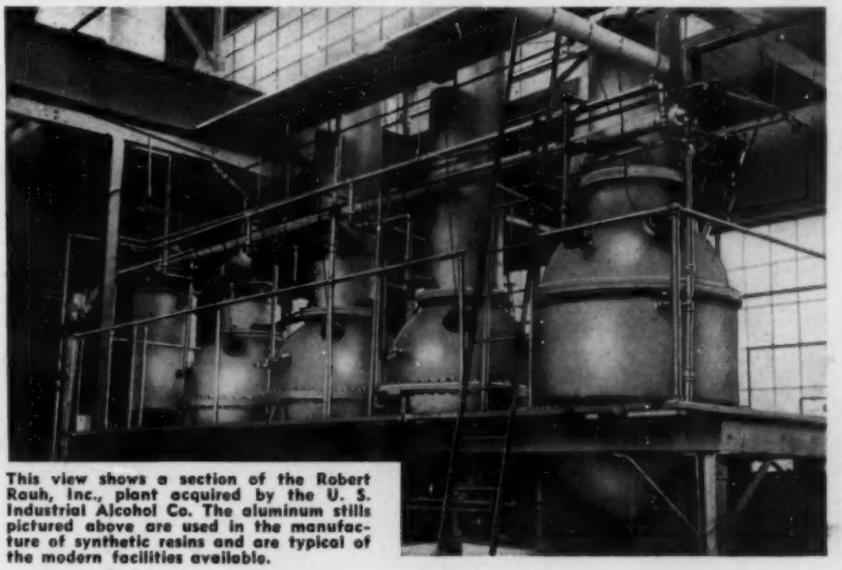
Dimethyl Maleate and Diethyl Maleate are also high boiling solvents with respective distillation ranges of 198°–210° C. and 218°–230° C. at normal atmospheric pressure. Laboratory tests have shown that Dimethyl Maleate is an active solvent for cellulose acetate even when used with up to 50 per cent of ethyl alcohol, Solox* and the Ansols.*

*Registered trade marks of the U. S. Industrial Chemical Co., Inc.

### High Wet-strength Paper

A water-absorbing paper product of high wet-strength can be produced by impregnating a highly porous paper body with a dilute solvent (acetone or ethyl acetate) solution of cellulose acetate, it is claimed in a patent recently issued. About 0.5-2.0% of the ester is used, based on the dry weight of the paper. The volatile organic solvent is removed and the cellulose acetate remains among the interstices of the paper, the patent states.

**[Among the products mentioned above, U.S.I. manufactures acetone, and ethyl acetate.]**



**This view shows a section of the Robert Rauh, Inc., plant acquired by the U. S. Industrial Alcohol Co. The aluminum stills pictured above are used in the manufacture of synthetic resins and are typical of the modern facilities available.**

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MAY ★ **SOLVENT NEWS** ★ 1938

## Devise Simple Test For Quality Of Castor Oil In Cotton Solutions

BALTIMORE, Md.—A simple qualitative test for distinguishing the quality of castor oil present in nitrocellulose solutions has grown out of observations by U.S.I. chemists that a black, sticky oil drips from burning films containing this substance.

In actual operation the test consists of preparing a strip (½" by 1") of test film from the solution under examination, igniting it and then noting the rate at which the black, sticky oil drips. This rate, previous experiments have shown, is always in direct proportion to the amount of castor oil present and in inverse proportion to its viscosity.

Neither dibutyl phthalate nor treated linseed oil exhibit this behavior, nor do they change the rate of drip if present in the same film with castor oil.

It is believed that this method may be applicable over a fairly wide range of conditions since tests with films of nitro-cellulose solutions formulated with seven different castor oils (raw, pale blown, and five processed grades) in amounts varying from 33% to 160% by weight of nitrocellulose yielded consistent results. The nitrocellulose used was an R.S. grade, 6, 8, 20 and 39 second viscosity.

## Uses Medium Boilers In Quick-dry Printing Ink

NEW YORK, N. Y.—Use of a blend of medium-boiling lacquer solvents in the formulation of a quick-drying printing ink is described in a patent recently granted an inventor of this city. The ink is reported especially adapted for printing on non-absorbent material, such as the tinned plate used in the manufacture of cans.

The new ink is said to contain cellulose nitrate dissolved in a mixture of amyl acetate and diacetone alcohol, gum copal, ester gum dissolved in a mixture of butyl alcohol and butyl propionate, a non-volatile plasticizer, soft soap, coloring ingredient and magnesium carbonate.

**[Among the products mentioned in the article above, U. S. I. manufactures amyl acetate, butyl alcohol, butyl propionate and plasticizers.]**

## *Process Extracts Zein Suitable For Plastics*

TERRE HAUTE, Ind.—By holding the temperature between 55°-60° C., and the final pH within the range of 6.0-7.0, it is possible to extract commercial quantities of zein, suitable for use in the production of plastics from maize proteins, according to an inventor here. Zein obtained by previous extraction processes has not been suitable for plastics, it is claimed in the patent.

A suitable process outlined in the patent comprises adding 93% ethyl alcohol to ground gluten meal, agitating gently during the extraction period, decanting, and repeating the process until the extraction is complete. The alcohol should be brought to a temperature such that after adding it to the meal, the resulting temperature is within the preferred range. Alkali may be added at the beginning or during the extraction to maintain the specified hydrogen ion concentration.

## U.S.I. Enters Resin Field

*(Continued from previous page)*

the company concentrated on the manufacture of ester gums.

Following the war, expansion in the paint, varnish and lacquer industries created a demand for improved finishes, and ester gums soon became an important raw material for these new finishes.

A few years later, the Rauh company again expanded its facilities and began the manufacture of phenol-formaldehyde resins and copal esters. Subsequently, the company added a line of alkyd resins and urea resins and, since Repeal, has resumed the manufacture of a considerable volume of brewer's pitch for lining beer barrels, kegs and other brewer's equipment.

### New Units Installed

In 1937, new units for the manufacture of phenolic and alkyd resins were installed to enable the company to meet the increased demands for resins of this type, and to keep pace with rapid developments in the field.

Major distribution of Rauh products has, until now, been in the East, although they are known in the midwest as well as on the Pacific Coast. Synthetic resins will be nationally distributed by U.S.I. sales offices in all leading cities.

## TECHNICAL DEVELOPMENTS

*Further information on these items may be obtained by writing to U.S.I.*

**A dispersion agent** whose use, it is claimed, so facilitates the dispersion of carbon blacks that enamels with improved gloss and bluer tone can be produced, was introduced recently. The manufacturer also states that stronger tints and lower grinding costs are other advantages obtainable. **(No. 91)**

U S I

**To illuminate the inside of barrels,** drums, tanks, etc., a special stick-like flashlight is now on the market. The aluminum lamp is said to be safe in the vicinity of explosive fumes and dusts, and is easily manipulated. A mercury switch in the shank automatically turns off the light when not in use. **(No. 92)**

U S I

**Fatty acid soaps** unique in their oil solubility and in their ability to emulsify oil systems are said to be among the products which can be formed from a non-volatile tertiary amine recently introduced. The compound, described as amphoteric, also forms water soluble salts with inorganic acids, is a solvent for a wide variety of compounds, and is useful as an ingredient in paint removers as well as in certain syntheses, it is stated. **(No. 93)**

U S I

**A new thermoplastic coating** for the inside of containers is said to resist acids and alkalies, as well as water and some alcohols. According to a recent announcement, the coating is easy to apply, retains its protective characteristics almost indefinitely and is an effective moisture-proofing agent. **(No. 94)**

U S I

**Standard quart cans** can be used with siphon feed spray guns by means of a special cover, according to a recent report. The cover is said to lock in any position on the circumference of the container, protect against leakage, and permit the user to make rapid changes without cleaning standard containers. **(No. 95)**

U S I

**Metal furniture putty,** which can be applied to steel, aluminum and other metals, is now on the market. According to the manufacturer, it can be applied with a knife or, if thinned, by spraying or brushing. The putty air dries or bakes and, when hard, sands freely to a smooth surface, it is claimed. **(No. 96)**

U S I

**Wide-range indicator papers** that pass through five color changes in the range pH 2 to pH 10 are now supplied by one manufacturer. They can be used with turbid and highly colored solutions by observing color of outer diffusion zone on spot tests, he reports. **(No. 97)**

U S I

**A new preservative and antioxidant** is said to prevent both decomposition and polymerization of linseed oil when added in the proportion of 1:1000. The product is also effective with other vegetable oils, blood albumen and is soluble in most organic solvents and vegetable and mineral oils, according to the manufacturer. **(No. 98)**


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# SOLVENT NEWS

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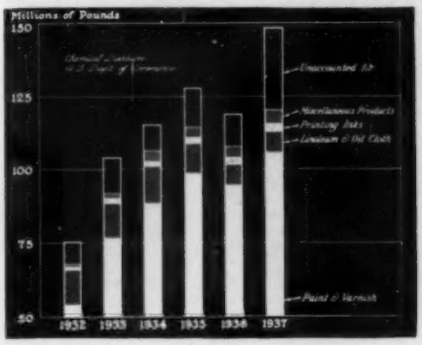
JUNE ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1938

## U. S. TUNG OIL CONSUMPTION




## Use New Denaturant In C.D. 14 Formula; T.D. to Revoke C.D. 11 July 1st

WASHINGTON, D. C.—A new formula for Completely Denatured alcohol was authorized by the Treasury Department on April 29 to replace the present C.D. formula No. 11. The new formula, to be known as C.D. 14, became effective immediately. Formula C.D. 11 is revoked as of July 1, 1938.

Treasury Decision 4802 authorizes the following composition for the new formula:

To every 100 gallons of ethyl alcohol of not less than 160° proof add:
5 gallons of FD-13 or a product similar thereto,
2.25 gallons of methyl isobutyl ketone

Specifications for Denaturant FD-13 were made public by the department on May 14, in AT-Circular No. 387. The circular states, "this material consists of organic hydrogenated and dehydrogenated products free of water and suspended matter, and is distinguished by its characteristic taste and odor."

Methyl isobutyl ketone is now used as a denaturant in C.D. formulas 12 and 13, which continue in force.

*[The above information has been extracted from T.D. 4802 and AT-Circular No. 387, to which reference is made for the full text.]*

## Alcohol Drying Yields Wool Fibers From Silk

FRANKFORT-ON-THE-MAIN, Germany—Wool-like fibers can be made from artificial silk by dehydrating with alcohol, it is claimed in a patent recently granted three inventors here. Fibers produced by the new process possess warmth, softness, elasticity and strength approaching that of natural wool, the inventors report.

In place of washing and drying filaments obtained in the production of artificial silk by the cuprammonium process, the inventors suggest preliminary drying by mechanical means, followed by dehydrating by passing through successive baths of increasing alcohol concentrations (from 30% to 95%).

**[All C.D. and S.D. alcohol formulas are available with U.S.I. Anhydrous Alcohol.]**

### Paper Collapsible Tubes

As part of its program of "ersatz" Germany has been experimenting, for a number of years, with paper tubes to replace tin and lead, according to an article in the *Packaging Parade*. Special resin adhesives have been developed and many new styles and shapes have been introduced, the article reports. A white coat of "paint" is said to give the tubes an appealing appearance.

# U.S.I. Synthetic Resin Division Makes Wide Range of Ester Gums

### Varies Properties to Meet Special Requirements of Coatings, Ink, Adhesive, Linoleum, and Floor Tile Industries

Manufacturing operations of the synthetic resin division of the U. S. Industrial Alcohol Co., formerly the business of Robert Rauh, Inc., have now become integrated with other U.S.I. operations. With the addition of these new manufacturing facilities, U.S.I. is able to offer its customers a closely knit service that covers a complete line of synthetic resins as well as important solvents and chemicals. Products of the synthetic resin division include phenolics, alkyds, copal esters and ester gums.

*This is the first of a series of articles which outline some of the principal applications of synthetic resins manufactured by the U. S. Industrial Alcohol Co. Subsequent articles will describe phenolics, alkyds and copal esters.*

To meet the individual requirements of the protective coatings, printing ink, adhesives, linoleum and floor tile industries, U.S.I. Ester Gums can, by use of proper equipment and control in the course of manufacture, be varied in such characteristics as color, hardness, acidity and solubility. This versatility of U.S.I. Ester Gums, apart from their initially low cost, fits them to many special applications.

### Seven Types of Ester Gums

Among the ester gums offered by U.S.I. there are five general types manufactured from rosin and two from copal gum. Rosin esters range from the low acid number, pale-color type to the high acid number, alcohol-soluble type.

A number of manufacturers, faced with the problem of formulating lacquers with a relatively high resin-cotton ratio or with solvent blends consisting substantially of low boilers, have found Rauzene AS-1 a valuable aid in overcoming "blush." This characteristic, coupled with a high alcohol tolerance, is favorable to the use of less expensive solvent blends and has placed AS-1 in an important position on the list of resins used in economical lacquer formulations.

In varnishes of high water resistance, outdoor durability, fast drying qualities and freedom from livering with basic pigments, Rauzene 1 and Rauzene 00 are finding a widening circle of uses. Rauzene 1 is characterized by extra hardness and a very high melting point. Consequently, it is also adapted to lithographic varnishes.

### Good Outdoor Durability

In addition to its well founded applications in varnishes, Rauzene 00 is extensively used in lacquers. Because of its particularly good color retention and the fact that it is one of the most easily handled resins, 00 Ester Gum has more or less justifiably earned the name of an "all-purpose" resin. Rauzene 4LW is a

*(Continued on next page)*

## *Bill Increases Alcohol Tax 25c a Proof Gallon*

WASHINGTON, D. C.—Needing only the signature of President Roosevelt to become law, the tax bill passed by the House on May 11 provides for an increase of 25c a proof gallon on the present $2 per proof gallon tax on distilled spirits. The added tax will increase the cost of 190 proof industrial alcohol by 47½c per wine gallon. Authoritative reports said that it was expected that the President will sign the bill.

The measure as sent to the White House did not contain a tax on floor stocks. The following day, however, a bill which does include a floor tax was introduced.

## Inventor Uses Ethylal For "Germicidal" Paint

WOODHAVEN, N. Y.—A paint containing ingredients "which, during the normal life of the surfacing film, continuously and progressively are latent with the property of generating toxic components to bacteria, germs, fungus and other pathogenic bodies" is revealed in a patent granted to an inventor here.

Explaining that he has adopted as an ingredient, ethylal which generates minute quantities of formaldehyde, the inventor points out that he also utilizes the "toxic properties" of chlorine, sulphur, phenol and formaldehyde as the active components in a vehicle.

Ethylal, or other high-boiling acetals, is added to the thinner in the proportions of 2%-50% by volume, although the inventor prefers about 10% as the optimum amount. Sulphur and chlorine may be introduced as sulphur monochloride for polymerizing perilla oil. Phenol and formaldehyde are condensed in the presence of wood oil, rosin (or ester gum) and sulphur monochloride to provide a "metastable" phenol formaldehyde resin varnish.

The final paint, combining polymerized perilla oil, phenol resin varnish, and ethylal-bearing thinner, forms a "durable finishing material of innocuous character during application" but which renders available "components conductive to hygienic conditions."

**[Among the products mentioned above, U.S.I. manufactures Ester Gum and Phenolic Resins.]**

**New Solox Drum**

**Latest addition to the family of easily identified U.S.I. containers is this attractive blue, red and white 5 gal. drum for U.S.I.'s proprietory solvent.**

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JUNE ★ **SOLVENT NEWS** ★ 1938

## Says Nitrostarch Makes Low Viscosity Lacquers of High Solids Content

JERSEY CITY, N. J.—How he has succeeded in producing from nitrostarch, lacquers which can be applied—in spite of their solids content of 70%—to paper, rubber, etc., in a single coat so as to yield films as thick as 0.002" or as thin as 0.0003" is revealed by an inventor of this city in a patent just granted.

A typical formulation is given as:

| | Parts by weight |
|---|---|
| Nitrostarch-viscosity 4-6 centipoises | 40 |
| Ester gum | 5 |
| Dibutyl phthalate | 16 |
| Paraffin | 1 |
| Solvent mixture | 38 |
| | 100 |

The solvents employed are, according to the patent, alkyl acetates, ketones, aromatic hydrocarbons, aliphathic hydrocarbons, etc., in which nitrostarch is soluble and mixtures of these compounds with each other or with diluents such as alcohol.

Films of nitrostarch, the inventor explains, are ordinarily both weak and brittle, yet with the incorporation of 42-46% plasticizer of the weight of nitrostarch (amounts regarded as excessive in conventional lacquers), these films can be made to adhere so strongly to backings such as paper, that film and backing act almost as a "unitary mass." Tackiness is prevented, he asserts, by adding hydrocarbons such as paraffin.

At the same time, the inventor continues, nitrostarch lacquers of this type have other outstanding advantages including lower cost than nitrocellulose of the same viscosity, stability on long exposure to strong sunlight, imperviousness to moisture, and the ability to be "heat sealed." Further, he adds, they reduce the amount of solvent required.

**[Among the products mentioned above, U.S.I. manufactures Ester Gum, Dibutyl Phthalate, and Alkyl Acetates.]**

## Telephones Need No Power

Telephones which require no batteries or other power source to operate the speaking circuit were announced recently. Unusual clearness and fidelity, elimination of maintenance, safety, and portability are some of the advantages claimed. According to the manufacturer, the speaker's voice, acting on a diaphragm in the mouthpiece, induces currents which are converted into the original vocal tones by the receiving telephone.

## Two New Denaturants For Ethyl Acetate Approved

WASHINGTON, D. C.—Explaining that the Treasury Department "has determined that under present conditions denaturing grade wood alcohol or methyl isobutyl ketone possess denaturing properties as satisfactory as the denaturing properties of calol ethatate," Stewart Berkshire, Deputy Commissioner, recently notified producers that both products had been added to the list of approved denaturants for ethyl acetate.

Ethyl acetate, except when used for pharmaceutical, scientific and food preparations or as a denaturant for S.D. alcohol must be denatured in accordance with T.D. 4748.

Mr. Berkshire's announcement, AT-Circular No. 374, states that producers may in the future add either one gallon of methyl isobutyl ketone or 5 gallons of denaturing grade wood alcohol in lieu of ⅛ gal. of calol ethatate to every 100 gals. of ethyl acetate.

He also said: "When a user desires to obtain ethyl acetate denatured with chemicals other than calol ethatate, denaturing grade wood alcohol, or methyl isobutyl ketone, application must be made in accordance with the provisions set forth in Treasury Decision 4748."

*[The above information has been extracted from AT-Circular No. 374, to which reference is made for the full text.]*

## Resin Division Makes Variety of Ester Gums

*(Continued from previous page)*

a similar resin, but has a slightly lighter color and is not quite as hard.

Among ester gums used for adhesives, emphasis is naturally placed upon the plastic nature and surface tack of the resin. Rauzene AS-6 has been developed specially for this purpose. It is considerably softer in melting point (45-55 deg. C.) than other U.S.I. Ester Gums so that it develops a very desirable surface tack. This same property has also been responsible for its use in lacquer formulations where a plasticizing action is desirable.

Alcohol solubility, a feature not usually found in common ester gums, is a distinguishing characteristic of Rauzene AS-90. This adapts it to spirit varnishes. Having also low viscosity characteristics, it may be employed in lacquers of high solids contents.

Charts listing the principal physical characteristics of U.S.I. Ester Gums may be secured by writing to U.S.I.

## TECHNICAL DEVELOPMENTS

*Further information on these items may be obtained by writing to U.S.I.*

**A new type of napthenic sulphonate** is said to be preferentially oil soluble and to have exceptional ability in the preparation and stabilization of emulsions such as cutting oils, orchard sprays, wool oils, lacquers, etc. It is also described as a good thixothropic agent. **(No. 101)**

U S I

**Plastic tubing for conveying alcohol** and other organic solvents has been introduced. Having remarkable pressure resistance, flexibility that permits it to be "tied into knots" and the ability to resist prolonged vibration, it has the added advantage, acording to the manufacturer, of being completely inert to gasoline, oil, ethers, esters, alcohols, ketones, etc. **(No. 102)**

U S I

**Mica-pulp** containing 25% altered mica by weight is now available for casein paints. The product is said to impart unusual covering power and workability since it possesses properties midway between ordinary mica and vermiculite. **(No. 103)**

U S I

**A new metal protective** is said to have unusual adhesive strength and highly polar chemical acting inhibitors of corrosion. Great advantage is claimed for the material when used on metals subject to exceptionally corrosive conditions and subsequent cleaning. **(No. 104)**

U S I

**A new preservative for wood, canvas and net** is described as a combination of chemicals which penetrates the cells of wood and other materials and affords permanent protection against rot, mildew, toredos, termites, etc. **(No. 105)**

U S I

**Acetate of soda** in the form of "puffy kernels" which do not harden or pack together, was introduced recently. The manufacturer describes the product as an iron-free technical grade which is speedily soluble without boiling or cooling. It is available in barrels or multiwall paper bags.

U S I **(No. 106)**

**A cleaning solution,** now available for the removal of brass tarnish and oxide film, is said to impart a satin-like finish which remains bright for a year or more. The manufacturer claims it is non-fuming, and forms an invisible film over the metal surface. **(No. 107)**

U S I

**Shrinkage in mortars** can be eliminated by adding specified quantities of a new material, containing iron particles, the manufacturer claims. Expansion of the iron particles is said to compensate for natural shrinkage in concrete, thus allowing for complete bonding of new concrete with old. It is also recommended for grouting, repairing and resurfacing floors, repairing under aggressive water conditions, etc. **(No. 108)**

U S I

**Synthetic fatty acids** and glycerides which are said to have valuable film-forming properties were recently introduced. The manufacturer states that they consist of relatively pure, highly unsaturated acids similar to clupanadonic and linolenic acids and that they are almost as low in cost as the raw oils from which they are prepared. **(No. 109)**


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***DIATOL**
**DIETHYL CARBONATE**

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# SOLVENT NEWS

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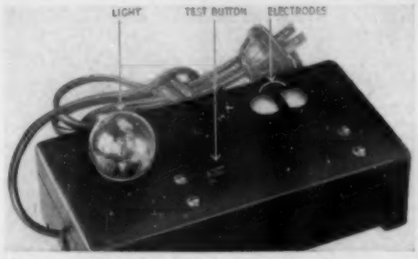
JULY ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1938




## Electrical Resistance Detects Emulsion Type

An instrument for determining whether emulsions are the "water-in-oil" or "oil-in-water" type utilizes their difference in electrical conductivity, according to a recent article. A dab of the cream to be tested is placed between two nickel silver electrodes and the circuit is closed with a test button. An "oil-in-water" emulsion will pass sufficient current to light a low-wattage neon bulb, while a "water-in-oil" type will not, it is said.

**Testing Cosmetic Creams**

The author claims that the instrument is useful "in developing creams and other emulsions . . . to demonstrate whether a cream is of a 'nourishing' type, that is, water-in-oil, or a 'vanishing' type, oil-in-water . . . to study the inversion of emulsions and also to determine whether an emulsion or cream is breaking."

## Mfg. Chemists Assn. Told Cost of "Chemical Jobs"

SKYTOP, Pa.—It takes an average investment of $11,250 for each job in a chemical plant, or $8,156 based on "factory and non-factory chemical employees," members of the Manufacturing Chemists Assn. learned at their meeting here on June 2nd. This statement was read from the report of a survey made by the Chemical Alliance which also showed the $5,223 of the latter figure is for capital assets and $2,933 for working capital.

A record attendance of 200 members re-elected last year's officers as follows: president, E. M. Allen; vice presidents, George W. Merck, Charles Belknap, and J. W. McLaughlin; secretary, Warren N. Watson; executive committee, H. L. Derby, chairman, Leonard T. Beale, William B. Bell, R. N. Chipman, J. H. Dunbar, Russell H. Dunham, Lammot duPont, August Kochs, Clyde D. Marlatt, Charles W. Millard and Chas. S. Munson, president of the U. S. Industrial Alcohol Co.

## New Reagent Identifies Viscose, Bemberg Silks

CAMBRIDGE, ENGLAND—Viscose and Bemberg silk may be readily distinguished in ultra-violet light by use of the following reagent, it is reported in *Nature:*

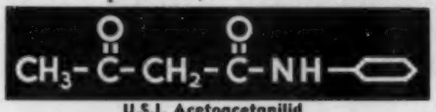
0.5 gram of acronol yellow T.S. is dissolved in 50 cc. alcohol and the solution mixed with a solution of 0.5 gram anhydrous sodium carbonate in 50 cc. water heated to boiling and allowed to cool. The material under examination is immersed for a few seconds in the reagent, then removed, washed with cold or warm water and examined in filtered ultra-violet light.

Bemberg silk fluoresces, it is said, with a brilliant bluish color, viscose a very dull blue, and cellulose acetate a luminous violet-blue.

# U.S.I. Products Spur Advances In Color Photos and Resin Synthesis

### Acetoacetanilid In New Color Photography Developer; Ethyl Acetoacetate Aids Amine-aldehyde Resin Manufacture

NEW YORK, N. Y.—To their important uses in the manufacture of Hansa yellows and other dyes may be added two potentially significant applications for the U.S.I. products, Acetoacetanilid and Ethyl acetoacetate, recent patents granted by Patent Offices in two countries indicate.




U.S.I. Acetoacetanilid

Successful application of Acetoacetanilid in a process for the production of colored photographic images in layers of gelatin or carrier, such as collodion or an organic ester of cellulose, is reported in this country by inventors Leopold D. Mannes and Leopold Godowsky, Jr.

On another front, a new British patent reveals how Ethyl acetoacetate may be used in the manufacture of amine aldehyde resins which have valuable properties.

Considering all the implications of the two patents, it would seem a fair guess that there remain many unexplored applications for Acetoacetanilid and Ethyl acetoacetate and that research with the compounds will pay dividends.

**Has Reactive Methylene Group**

Mannes and Godowsky, for example, found that when Acetoacetanilid is incorporated in a developer, colored compounds result from a coupling of the oxidation product of the developer (mono-, di-, and triamino aryl compounds) to the reactive methylene group of the Acetoacetanilid, the patent papers disclose. An important condition which this reaction meets is, they assert, that the color forming compound (Acetoacetanilid) is not oxidized by the sodium sulphite which it is desirable to have in the developer.

This is especially valuable, they point out, because it makes possible the deposition of colored photographic images in the gelatin or other silver halide carrier adjacent to the metallic silver grain and simultaneously with development. Further, they emphasize, the dyes thus formed do not readily wander from the place of formation.

In other variations of the process, they mention that it is also possible to incorporate the Acetoacetanilid in the sensitive emulsion layer. Also, by employing films with superposed layers of emulsions, differentially sensitized, the dyes formed may be bleached, col-

(*Continued on next page*)

## Varnish Makers Can Reduce Resin Stocks

How the varnish maker can reduce resin inventories by selecting from three fundamental types will be the subject of an article in the next issue of SOLVENT NEWS.

The three resins—Rauzene N-100, Rauzene N-300 and Rauzene QD 1—are phenolics manufactured by the Synthetic Resin Division of the U. S. Industrial Alcohol Co. Samples of these resins or others in a complete line of phenolics may now be secured from U.S.I.

## Alcohol Is Solvent In New Dry Cleaning Fluid

COLORADO SPRINGS, Colo.—Denatured alcohol properly combined with other ingredients will produce an outstanding dry cleaning fluid, it is claimed in a patent granted an inventor here. A preferred formula described as both "pervious" to water and completely miscible with dry cleaners' gasoline or Stoddard's solvent is given as follows:

| | |
|---|---|
| Benzol | 53 oz. |
| Stoddard's solvent | 32 " |
| Denatured alcohol, special formula | 11 " |
| Oleic acid | 16 " |
| Amyl acetate | 3 " |
| Castile soap (by wgt.) | 2 " |
| Ammonia water | 3 " |
| Pure water | 8 " |
| Caustic potash (by wgt.) | ¼ " |

The denatured alcohol the inventor prefers is composed of 100 parts by volume ethyl alcohol, 5 parts wood alcohol, or other pure methyl alcohol, 5 parts ethyl acetate, 1 part aviation grade gasoline. [Ed. Note—This is practically identical to the composition of U.S.I.'s proprietary solvent SOLOX.] Methyl alcohol, ethyl acetate and gasoline increase the solvent and detergent properties, it is said.

Because this liquid is free from heavy oils, it requires less distilling and caustic to purify after it has been used, the patentee declares. This features, he adds, also makes it an easy liquid to filter through fine metal screens.

**SPOTTING**

**Removal of stubborn spots on fabrics, fur, leather goods, etc., without injury to the garment is claimed for the dry cleaning fluid, described above, made with alcohol.** *Picture courtesy the National Cleaner & Dyer*

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JULY ★ **SOLVENT NEWS** ★ 1938

## Water-saturated Butyl Alcohol Extracts Most Carotenoid From Cereal

WINNIPEG, MANITOBA—Extensive tests indicate that water-saturated butyl alcohol extracts more carotenoid pigment from cereal products than the naphtha-alcohol commonly used, experimenters from the Grain Research Laboratory here report.

Extracts obtained are easily centrifuged or clarified, are extremely brilliant and free from turbidity, and have comparable spectral distribution curves, their report, published in a recent issue of *Cereal Chemistry*, states. Other advantages in favor of butyl alcohol are its relatively low solvent power for the flavone pigments of flour and its stability to atmospheric moisture conditions.

Previous objections to naphtha-alcohol solution have been based on its sensitivity to moisture and a tendency to separate into two phases.

The experimenters investigated more than 60 commercially available organic solvents but state they found none which met all requirements as well as did butyl alcohol containing about 19.5% water of its weight at room temperature.

## Claims Elimination Of Free Ions Stops Rust

SELINSGROVE, Pa.—How to prevent rust and corrosion on iron and steel by coating the surfaces with a composition which forms non-ionizing iron salts is revealed in a patent recently granted an inventor here.

Nitrogen-containing chemicals such as ammonium sulfocyanate, potassium ferrocyanide, urea, and the like, are adaptable to this method of treatment, the patent reports. The inventor cites his preference for the ammonium compounds of these reagents, however, since it is easier, he claims, to eliminate such volatile bases by the heating or baking operation which is part of his process.

A typical composition is given as follows: Using 125 cc. of butyl alcohol as a blending agent, 200 cc. of gasoline are mixed with a solution consisting of 7 gr. of ammonium sulfocyanate in 75 cc. of methanol. The resulting solution is mixed with a suitable priming paint and applied to the iron or steel articles. Heating to about 200°F for about 30 minutes eliminates the ammonia and volatile solvents.

Surfaces treated in this manner may be subjected to any desired finishing operation, the inventor asserts.

## U.S.I. Products Aid Color Photos, Resin Synthesis

(*Continued from previous page*)

ored and rebleached a number of times without destruction of the silver image, thus permitting the formation of natural colored images in superposed layers.

When 15 parts of acetoacetic ester (Ethyl acetoacetate), 43 parts of diethylaniline and 75 parts abietinol are mixed with 450 parts water and 700 parts acetaldehyde, a crude resinous material forms under certain conditions, British Patent 474,034 reveals.

Reacting this crude material with 190 parts of 30% formaldehyde solution and following with suitable treatment, results in the formation of a pale, hard resin with a softening point of 63° C. This resin, the patent papers continue, is suitable in many applications, a few of which are spirit varnishes, oleoresinous finishes, nitrocellulose lacquers, and as a polishing agent for light colored woods.

Of course, this is not the first time the importance of Ethyl Acetoacetate in synthesis has been recognized. The reactivity of the hydrogen on the Carbon adjacent to the $C00C_2H_5$ group is well known. As a further example, the products formed by the addition of ammonia, aniline, urea and like compounds have a tendency to close into ring structures of the most varied types.

**U.S.I. Ethyl Acetoacetate**

Many of these developments have been held in abeyance by the former high price of this ester. However, if the British Patent described is any criterion, it now seems established that, at its present moderate price, Ethyl Acetoacetate is destined for some unusual commercial uses, in addition to its present applications.

For more than a decade U.S.I. has been the foremost manufacturer of Ethyl Acetoacetate and Acetoacetanilid. Manufacturers may secure from U.S.I. samples of current production for experimental purposes.

## TECHNICAL DEVELOPMENTS

*Further information on these items may be obtained by writing to U.S.I.*

**Concrete, stucco and masonry** can be protected against staining and efflorescence by spraying or brushing with a new transparent damp-proofing material, a recent announcement states. The liquid is said to be water-white, not a wax solution, and to have excellent penetrative qualities.
U S I **(No. 111)**

**A viscosity stabilizer** with strong wetting and anti-oxidant properties has been introduced, according to a recent report. It is soluble in all vegetable and animal fats, waxes, petroleum oils and distillates, the manufacturer states. Specific applications named are in varnish and lacquer manufacture, textile industry and in stabilizing suspensions of dry materials in oily mediums.
U S I **(No. 112)**

**Glassine paper fused** with a microscopic film of aluminum has been developed to provide a low cost metallic wrapping. Principal advantages of the product are high grease- and moisture resistance and repellency to light and heat, according to the manufacturer. **(No. 113)**
U S I

**Rust preventive paint** which can be applied directly over any rusted or new, damp or dry surface is now on the market. The paint resists acid and alkali fumes and brine and by penetrating beneath the rust particles expels moisture, the manufacturer states. It is available in four colors and aluminum and clear forms. **(No. 114)**
U S I

**Glass, metal foil, stainless steel,** aluminum, copper, etc., can be banded to porous surfaces such as wood, plaster walls, etc., with a new "animal base" glue in water solution, according to the manufacturer. He also states that the glue does not "blister" under any weather conditions; may be applied by brushing or spraying, and can be made waterproof by suitable modifications.
U S I **(No. 115)**

**A penetrating and bonding oil paint** which is said to combine some of the best features of both oil and casein paints, has been introduced. Principal advantages listed by the manufacturer are: suitable to application directly over calcimine or whitewash and damp surfaces, and sealing of water stains in one coat. It can also be supplied with a fungus and termite preventive, an announcement states. **(No. 116)**
U S I

**Economical and efficient agitation** or mixing of lacquer, synthetic enamel and other pigmented finishing materials, is claimed for a new hinged-lid mixing tank. The hinged cover is said to permit quick, easy filling yet, when clamped down, provides an inert atmosphere which prevents oxidation, leakage and overrunning. **(No. 117)**
U S I

**Fine copper particles** for incorporating in lacquers and oil, varnish and synthetic vehicles are said to give a non-porous, more impervious film, better gloss and 10 to 25% more coverage than copper heretofore on the market. Pastel shades are available, the manufacturer reports. **(No. 118)**


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# SOLVENT NEWS

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August ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1938

## Claims New Thermal Process Coats Paper Faster and Cheaper

### Heated Rolls Apply Mixture of Synthetic Resins, Rubber & Wax

Arrangements for licensing the manufacture of coated paper by the new "Dry Coating" process have been completed, Bert C. Miller, the inventor, disclosed to SOLVENT NEWS recently.

"Dry Coating" is a method of applying glossy or dull, smooth finishes to paper by means of a molten mixture of synthetic resins, waxes, crepe rubber and other coating materials. Neither solvents nor vehicle carrier are utilized, according to Mr. Miller. The plastic cools and sets on contact with the paper. Papers processed by this method have the appearance and feel of other coated papers but are several times more moisture resistant, Mr. Miller said.

**Cuts Cost 50-75%**

Chief interest, however, centers about Mr. Miller's statement that paper can be Dry Coated at savings of 50-75% under the cost of applying other special coatings to papers of equal weight. Comparing the process with various methods, Mr. Miller told SOLVENT NEWS that the cost is comparable to those of commonly used clay or casein coatings and varnish, but is slightly in excess of wax coatings.

Reference to the basic patents covering the process reveals that Mr. Miller dissolves shredded crepe rubber in a wax heated to its melting temperature, adds to this mixture a synthetic resin and other ingredients, depending upon whether transparent, opaque, glossy or dull finishes are desired. The following is a typical formula listed:

| | Percent |
|---|---|
| Rubber-wax | 5 |
| Compatible common resin | 60 |
| Stearic acid wax | 5 |
| Metallic soap | 20 |
| Non-oxidizing oil plasticizer | 10 |

Relatively few resins may be used, Mr. Miller indicates, but modified alkyds have been employed successfully. Others found suitable

(*Continued on next page*)

## Pigment Performance Is Predicted By New Table

HALEDON, N. J.—A new classification system for pigments utilizing 11 basic groupings has been announced here by V. C. Vesce of the Harmon Color Works.

In place of previous systems based upon hue and color, Mr. Vesce has substituted groupings into which any given pigment may conveniently be placed by means of a few simple chemical tests.

Apart from simplifying the analytical study of pigments, the new system has been found especially adaptable in predicting a use for a pigment where another in the same class has been utilized, according to Mr. Vesce.

Believing that many SOLVENT NEWS readers would like to have copies of Mr. Vesce's article, it will be published in the 4-page SOLVENT NEWS folders mailed without charge to subscribers. To receive your copies, simply write to U.S.I. and ask that your name be added to the SOLVENT NEWS mailing list.

## *A.O.A.C. Adopt S.D. 30 For Fatty Acid Determination*

MENASHA, Wisconsin—Specially denatured alcohol formula No. 30 has been adopted by the Association of Official Agricultural Chemists for the determination of free fatty acid content of crude and refined oils, according to the Association's *Journal*.

In the method described, the fatty acids are titrated with caustic soda dissolved in S.D. 30 (Authorized Composition: to 100 gallons of ethyl alcohol add 10 gallons of pure methyl-alcohol).

## Non-Fiber Raising Stain Made With Ethyl Lactate

CLEVELAND, Ohio—By combining water with selected organic solvents so that all the water evaporates before the organic solvent, wood stains which are non-fiber-raising and non-bleeding may be produced, it is claimed in a patent issued to an inventor here.

"The organic solvents seem to exert a protective action on the wood fiber, preventing the water from soaking into the cells," the inventor asserts. At the same time, he adds, the combination makes it possible to use water-soluble dyes which have relatively good lightfastness and no tendency to bleed into lacquer finishing coats.

Citing an example of his invention, the patentee lists the following formulation which "will not raise the fiber on any wood at any working temperature."

| | Parts by Wgt. |
|---|---|
| Water-soluble dye | 0.25 |
| Water | 2 |
| Ethyl lactate | 5 |
| Methanol denatured alcohol | 3 |

The dye is first dissolved in the water, ethyl lactate added, and then alcohol. A formulation of this type will not leave a greasy residue, it is stated.

**[Ethyl Lactate is a product of U.S.I.]**

## U.S.I. Phenol Resins Eliminate Need For Large Inventories

### N-100, N-300 and QD-1 Types May be Adapted to Most Needs

Greater interest in and acceptance of the idea that no large number of phenolic resins is needed to meet the requirements of modern varnish formulation is indicated by the increasing tendency for manufacturers to standardize on three phenolics manufactured by the Synthetic Resin Division of the U.S. Industrial Alcohol Co.

Employed in proper combination and blend, these three resins—Rauzene N-100, Rauzene N-300 and Rauzene QD-1—make possible a substantial reduction in resin inventories without sacrificing, at the same time, any of the well recognized advantages of the phenolic class.

*This is the second of a series of articles which outline some of the applications of U.S.I. synthetic resins. Later articles will cover alkyds and copal esters.*

Varnishes formulated with Rauzene N-100, a 100% phenolic of the heat-reactive, heat-hardening type, are outstanding in their resistance to strong alkali, acid, and boiling water. Just a few of the many finishes for which N-100 is preferred are exterior enamels, spar and marine finishes, and even whites. In the latter use, N-100 probably outranks comparable grades of 100% phenolics.

Yet, with all its versatility, N-100 is one of the most easily handled resins, since its reaction in the varnish kettle with chinawood and other oils is completely controllable. A special point in its favor lies in the fact that cooking at temperatures of 460° F. gives complete gasproofness with wood oil.

In addition to this, mineral spirits can be used as the sole thinner in all oil lengths. As a result, N-100 is probably one of the most acceptable 100% phenolics for finishes that require extreme hardness combined with great flexibility.

A second broad type of phenolic resin manufactured by U.S.I. is Rauzene N-300, which has been

(*Continued on next page*)

**PAINT MANUFACTURERS faced with the problem of keeping resin inventories low can use three U.S.I. phenolic resins to produce a variety of finishes. Samples of these resins (described above) may now be secured from U.S.I.**

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August ★ **SOLVENT NEWS** ★ 1938

## Reduce Resin Inventory With U.S.I. Phenolics

(*Continued from preceding page*)

modified to give it special properties such as fast drying. The phenolic base from which N-300 has been derived is of the non-yellowing type so that very fine whites can be produced from vehicles containing this resin.

A typical application where the toughness of N-300 may be utilized is in floor varnishes. Another well-recognized use is in "four-hour" enamels.

In the lower priced class, but with many special advantages of its own, is Rauzene QD-1, also a modified phenolic. While QD-1 is not designed for white formulations, it has numerous other applications in clear varnishes and colored enamels where it imparts extreme hardness and very fast, tough drying.

### Special Grades Available

Like N-100 and N-300, QD-1 is also easily handled, and requires merely routine care to obtain best results. Any type of dryer may be used, either solid types, cooked in, or liquid types added after thinning.

In addition to the three fundamental phenolic types described above, U.S.I. manufactures several special grades which are supplied to fulfill certain specific requirements where definite characteristics are needed. A reference chart describing the complete line of U.S.I. phenolics will be supplied upon request.

## *Report World Chemical Industry Up During '37*

WASHINGTON, D. C. — Considerable improvement in the financial condition of the chemical industry is reported in "World Chemical Developments In 1937" just published by the Dept. of Commerce, Bureau of Foreign and Domestic Commerce. A copy of the highly informative 221-page booklet which is Trade Promotion Series No. 177 may be obtained from the Superintendent of Documents for 25 cents.

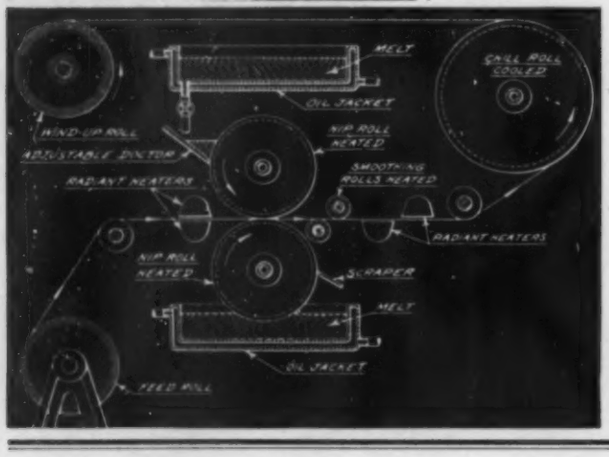
## New Heat Process Coats Paper Faster and Cheaper

(*Continued from preceding page*)

include varieties of modified phenolics. The plasticizer may be diamyl- or dibutyl-phthalate.

"Dry Coating" is essentially a surface coating, Mr. Miller emphasized. Poorly formed papers or very porous bases may be coated with very little penetration and no curling. Heavy films of six or eight pounds per 1,000 square feet, can be produced in one application, he said. In addition, Mr. Miller pointed out, the coating can be used for laminating.

At present the "Dry Coating" method cannot be applied to paper in sheet form because of manufacturing difficulty arising from immediate setting of the coating and the necessary control of tension, Mr. Miller explained. It can, however, be applied either before or after printing. Inks used for printing over the coating must dry by oxidation. Fifty different compositions have been developed to meet varying needs.




**"DRY COATING"**

**One or both sides of the paper may be coated with the equipment shown at left. The melt is kept at approximately 275-300° F. Paper passing from the feed roll through heated nip rolls receives a coating of predetermined thickness and moves on to a chill roll cooled preferably to sub-zero temperatures. Speeds ranging from 50 to 500 feet per minute are practical, according to Mr. Miller, inventor of the process.**

(*From B. C. Miller's patent.*)

## TECHNICAL DEVELOPMENTS

*Further information on these items may be obtained by writing to U.S.I.*

**Development of a new germicide and fungicide** with a phenol coefficient of 57 against *E. typhi* was announced recently. It is intended for use in the production of aqueous antiseptic solutions and the preservation of adhesives, pastes, hides, dextrine, albumen, etc. The product is said to be water-soluble, non-irritating to the skin and relatively non-toxic, especially in the low concentrations of practical use. **(No. 121)**

U S I

**Amorphous waxes** said to be good substitutes for beeswax and also for ozokenite in many applications have been introduced. The melting points range around 165°F. but films of the waxes are unaffected by submersion in water at 175°F., according to the manufacturer. The waxes are tasteless and odorless as well as plastic at freezing temperature, and remain amorphous after continued or repeated heating, he adds. **(No. 122)**

U S I

**A new type of cedar-leaf oil** for paints is described as a heavy viscous product like cedarwood oil, but which has all of the virtues of the original leaf oil, without its extreme volatility. This oil is said to possess strong insecticidal properties as well as an extremely fragrant and pleasing odor. **(No. 123)**

U S I

**Postitive detection of leaks** in refrigeration systems using chlorinated hydrocarbon refrigerants is claimed for a new halide leak detector. The detector uses an alcohol-type fuel said to burn with a distinctive color in presence of such refrigerants as Artic, Carrene, Freon, etc. **(No. 124)**

U S I

**A new emulsifying-type disinfectant** is said to have an unusually pleasing lilac odor, a phenol coefficient of 5 and is non-toxic, -corrosive, -irritating, -caustic or -poisonous. It is also stated that the material does not deteriorate with age and possesses an odor so pleasant that it can be diluted with water and used as a theatre spray deodorant. **(No. 125)**

U S I

**Ninety-nine per cent of the paint pigment** in fumes from paint spray booths can be removed by a new efficient and economical device which employs a set of precipitator plates and a water curtain, according to a recent announcement. **(No. 126)**

U S I

**Perfect wood grains,** marble effects, and other designs can be produced on either wood or metal by means of a new graining process, according to the developer. The process is expected to be of particular interest to manufacturers of home furnishings. **(No. 127)**

U S I

**Lacquer spray and solvent hose** lined with high-grade synthetic rubber material is said to resist the action of oils and commonly used paint solvents, even at temperatures up to 150°, without swelling. The hose is available in sizes from ¼- to ¾-in., an announcement continues. **(No. 128)**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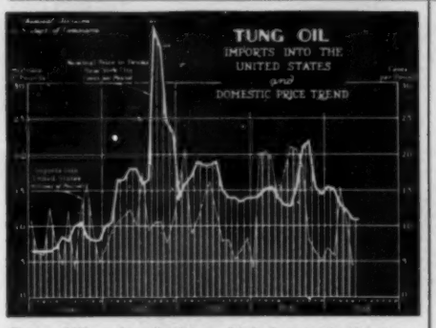
September ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1938




**Tung Oil's price decline which began in January, 1938, was checked for the first time last May, when the curve leveled off. Monthly imports in May were at the lowest level since January, 1937.**

## Produces Two-tone Metal Finish With Single Paint

BUFFALO, N. Y.—Only one type of paint product is needed to simulate two-toned metallic effects, such as hammered metal, according to a patent recently granted inventors here. Applied by spray gun, the finish is said to develop a hammered appearance almost immediately and may then be air-dried or baked.

Droplets from the spray gun form craters surrounded by shallow ridges, the inventors explain. Because the metallic powder migrates to the ridges while the granular pigment concentrates in the craters, the inventors continue, the color of the powders predominates at the ridges, while the craters are colored by the pigments. Two-toned effects are obtained by proper selection of metal powders and granular pigments, the patentees reveal.

A typical formulation for producing a hammered steel finish is given as follows:

| | |
|---|---|
| Carbon black | 0.51% |
| Antimony oxide | 9.68 |
| Diatomaceous earth | 1.54 |
| Aluminum bronze paste (about 66% aluminum powder and 34% mineral spirits) | 1.54 |
| Alkyd resin solution (50% resin, 50% solvents) | 47.94 |
| Mineral spirits | 1.74 |
| V. M. P. naphtha | 19.40 |
| High flash coal tar naptha | 1.22 |
| Xylol | 0.07 |
| Toluol | 16.36 |
| | 100.00% |

Other compositions may also be used for the paint, according to the inventors, as for example, oleoresinous varnishes, oil modified alkyd resins or clear nitrocellulose lacquers.

## Names Alcohols Which Retard Or Activate Seed Germination

PARIS, FRANCE—Immersing plant seeds in alcohol may retard or accelerate germination, depending on the kind of alcohol, it is revealed in the Bulletin of the Society of Portugues Scientists, published here.

Studying the effect on Brassica seed, the authors report that contact with ethyl alcohol for 15, 30 and 60 minutes retards but does not inhibit germination, resulting in smaller and chlorotic plants. Methyl alcohol, however, is said to accelerate germination after 20 to 90 seconds immersion, but for longer periods, acts the same as ethanol. Butyl alcohol activates germination, even with prolonged periods of contact, the article continues, whereas amyl alcohol generally exerts a retarding action and produces atrophied plantules.

## *Alcohol-Dispersed Stearate Gel Is Base For Improved Water-proofing Material*

LONG ISLAND CITY, N. Y.—How addition of ethyl alcohol to a gel of aluminum stearate transforms it into a thin, transparent, colloidal liquid suitable as a base for new waterproofing compositions is revealed in a patent just granted to an inventor here.

The resulting compositions are substantially colorless, and, if applied by brushing, spraying or immersion, will waterproof stone, brick, leather, fabric and paper "throughout their useful life," the inventor asserts.

In broad terms, they may be described as consisting of (1) at least one water-insoluble, fatty acid soap; (2) preferably a solid or semi-solid hydrogenated fish oil; (3) at least one hydrocarbon solvent; and (4) an alcoholic dispersing agent. The following is cited as a typical formulation:

| | Percent |
|---|---|
| Aluminum stearate | 6 |
| Hydrogenated menhaden oil | 6 |
| Hydrocarbon solvents, e.g. xylene and varsol (defined in patent papers) | 87 |
| Ethyl alcohol | 1 |
| | 100 |

The procedure is to prepare a gel by heating xylene and aluminum stearate at approximately 180° F., dispersing this with alcohol, and then adding the hydrogenated oil to the hot dispersed colloidal solution.

The unusual water-repellent properties of the composition are believed to result from a definite coaction between the several ingredients.

## Dry Ice Concrete Freezer

New York, N. Y.—Concrete or concrete aggregate specimens can be frozen with dry ice in acetone or kerosene by means of an inexpensive freezer described here recently. By alternately placing test cylinders in the freezer and in water at 70°F. for 30 minute periods, 24 freezing and thawing cycles are obtained per day, the article states.

# Promote Super Pyro Anti-freeze With Enlarged Campaign

### U.S.I. Tells '38 Plans As Early Orders Indicate Sales Boost

### LARGEST OUTDOOR USER

Over 8,000 outdoor posters in 500 centers and a 20% increase in space in four leading national magazines will constitute the foundation of the 1938 consumer advertising campaign to promote Super PYRO, the quality anti-freeze manufactured and distributed by the U. S. Industrial Alcohol Co.

Introduced in 1933 as the original, popular-priced, premium quality anti-freeze retailing at $1.00 per gallon (25c qt.), Super PYRO has maintained its leadership for six years. More than $1,500,000 has already been spent on the promotion of Super PYRO, resulting in a jump from 800,000 users in its first year to over 4,000,000 last winter and a total to date of 15,000,000.

The outstanding benefits derived from the use of Super PYRO include:

1. **Full Strength and Concentrated:** Provides extra margin of protection.
2. **Stops Rust and Corrosion:** Cooler running engine, freedom from radiator repairs.
3. **Longer Service:** Special oil reduces evaporation and loss from "after boil."
4. **Economy:** Complete winter protection at lowest cost.
5. **Non-poisonous:** No injurious effects from inhalation.
6. **Characteristic Color:** Retains color in radiator all season.

Motorists in 45 states will see the Super PYRO 24-sheet posters which, this year, feature the famous "Old Man Winter" in various poses depicting "defeat" with the caption, "has beaten Old Man Winter in 15,000,000 cars."

The magazine schedule provides up to five insertions in the *Saturday Evening Post, Colliers, Liberty* and *Country Gentleman.* The magazine campaign which begins about November 1st, provides a circulation of 9½ million readers and a total of 35,000,000 "impressions."

*(Continued on next page)*

**OVER 8,000 OF THESE POSTERS will appear approximately two weeks before the first cold spell in 500 centers in 45 states as part of U.S.I.'s 1938 campaign to promote Super PYRO anti-freeze. The consumer advertising schedule also includes color pages in four national magazines, radio and newspapers in certain metropolitan markets.**

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September ★ **SOLVENT NEWS** ★ 1938

## Printing Ink Chemists Prefer Solox In Making Alcohol Bleeding Tests

NEW YORK, N. Y.—SOLOX*, propietary solvent manufactured by the U. S. Industrial Alcohol Co., is the preferred solvent for making alcohol bleeding tests on pigments used for printing inks, it is announced in a recent issue of the *American Inkmaker*. Details of the test, which was formulated by the Technical Committee of the Printing Ink Production Club, are as follows:

"The pigment and varnish are mulled together in the same ratio as used in the strength test, or the mulled ink remaining from this test may be used. A dried drawdown or solid print of the ink, leaving some of the clear paper showing is suspended in a test tube three quarters full of SOLOX*, or equivalent brand of denatured alcohol, and allowed to remain for thirty minutes. At the end of this time the draw-down or print is removed from the test tube and any discoloration of either the alcohol or the plain paper surrounding the print is noted."

*Trade mark. Leaflet supplied on request.

## Use Magazines and Posters To Promote Super Pyro

(*Continued from previous page*)

Dealer prices for Super PYRO will remain the same as 1938—54c a gal. on large drums, 60c on the 5-gal. and 1-gal. cans, and 65c on the quart cans. West of the Rocky Mountains dealer prices are slightly higher and the retail price is $1.20 per gal. or 30c a quart.

U. S. I. continues its policy of consigning stock of Super PYRO to carefully selected distributors whose compensation for selling provide 25% return on 54-gal. and 5-gal. drums, and 24% on gallon and quart cans, on volume exceeding 4,000 gallons.

## *Find How To Make Dye For New Aluminum Test*

WASHINGTON, D. C.—The detection and determination of small amounts of aluminum by a recently published method depends upon the use of a uniform high-quality dye, according to World Trade Notes. Finding that a suitable reagent was not available, chemists at the National Bureau of Standards devised a method for the preparation of the ammonium salt of aurintricarboxylic acid. This dye is said to have proved entirely satisfactory in the test for aluminum.

## Alcohol Boosts Yield of Pulp From Cane Bagasse

AMES, IOWA—For increasing yields of pulp from sugar cane bagasse, a solution of nitric acid in ethyl alcohol is undoubtedly a superior pulping medium to aqueous nitric acid, S. I. Aronovsky and D. F. J. Lynch, experimenters in the U. S. Agricultural By-Products Laboratory here, report in *Industrial & Engineering Chemistry*.

They emphasise that ethyl alcohol has a depressing effect on the hydrolytic properties of nitric acid without greatly lessening its pulping or delignifying properties, and report a much greater retention of Cross and Bevan cellulose, alpha-cellulose and pentosans. From the paper-making point of view, as well as for viscose rayon, cellophane, plastics, and lacquer, the alcoholic acid pulp is particularly attractive.

About 30% of the 500,000 tons of bagasse produced yearly is estimated to go into the manufacture of insulating and building boards.

**SOLOX MAKES BOWLERS HAPPY**

**Mergard's in Cincinnati uses the anhydrous grade of U.S.I.'s proprietary solvent exclusively for cutting shellac with which the bowling alleys are finished. Solox is a stronger solvent than ordinary denatured alcohol and has no heavy penetrating odor. Other advantages of Solox are given in a descriptive leaflet available on request.**

## TECHNICAL DEVELOPMENTS

*Further information on these items may be obtained by writing to U.S.I.*

**A special finish for refrigerator ice trays** is said to facilitate release of ice cubes. The new finish is water-white, resists fruit acids, corrosion and cleaning compounds and dries hard in air in one to three minutes, according to the manufacturer. **(No. 131)**

U S I

**Flexible casein,** said to dissolve readily in water without heat, is described as a straw-colored transparent jelly, free from solid particles and having a pleasant odor. The water-solution dries rapidly to give a flexible, almost colorless, transparent film, the manufacturer states. **(No. 132)**

U S I

**A new striping tool** applies paint directly from standard collapsible tubes, according to a recent announcement. Eleven stripe width wheels are available. **(No. 133)**

U S I

**An ink deodorant** with a definite fruity note has been developed for applications where a perfume odor would be objectionable, according to a recent announcement. The manufacturer recommends it for use in inks for paper napkins, doilies, and food wrappers. **(No. 134)**

U S I

**Carboy drainers** designed to prevent accidents caused by splashing and carelessness in pouring are now available in three sizes—5 gallon, standard and large—a recent announcement states. The announcement further states that one user writes that the installation of a Carboy swing or rock ordinarily required by insurance regulations is not necessary when these drainers are used. **(No. 135)**

U S I

**A water soluble solvent** said to be particularly effective in removing fatty matter, soaps, and mineral oils from metal prior to finishing operations has been introduced. Surfaces treated are easily rinsed, free from deposited salts, and are protected from corrosion during short stocking periods, according to the manufacturer. **(No. 136)**

U S I

**New monochromatic filters** for isolating the prominent lines of the mercury spectrum at wave lengths 365, 405, 436, 546, 578 and 1014mu are said to be far superior to any previously available. Exceedingly high transmission can be had with purity factors from 90 to 99%, the manufacturer reports. **(No. 137)**

U S I

**Aluminum when tarnished** may be restored to a mirror finish by a new product which is said to dissolve oxidation and stains, according to a recent announcement. The product is said to work equally well on pewter and silver, gold, platinum, stainless steel, brass, and baked enamel surfaces. **(No. 138)**

U S I

**A surface resembling felt** may now be applied to any plastic by a new process of spraying flock, according to a recent report. The manufacturer points out that the flocking process costs from 30 to 40% less than the felting operation of putting bases on ring boxes and other items, to prevent them from scratching. **(No. 139)**


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# INDUSTRIAL CHEMICAL CO. INC.

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Secondary Amyl Alcohol

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Completely Denatured*
Anhydrous Denatured
Absolute—Pure
C.P. 96%—Pure and Denatured
Pure (190 Proof)—Taxpaid, Tax Free

*SOLOX—The General Solvent
*SUPER PYRO—The premium Quality Anti-freeze

**SYNTHETIC RESINS**

**BUTYL ALCOHOLS**
Normal and Secondary

**ISOPROPYL ALCOHOL**

**METHYL ALCOHOLS**
95%, 97% and Pure

**METHYL ACETONE**

**ETHYL ETHER**
U.S.P. and Absolute (A.C.S.)

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**NITROCELLULOSE SOLUTIONS**

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**DIBUTYL PHTHALATE**
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**DIMETHYL PHTHALATE**

**ACETIC ETHER**

**AMYL ACETATES**
High Test Commercial
Technical Secondary

**BUTYL ACETATES**
Normal and Secondary

***DIATOL**

**DIETHYL CARBONATE**

**ETHYL ACETATES**
85-88%, 95-98%, 99% and U.S.P

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**ACETONE**
**DIBUTYL OXALATE**
**DIETHYL OXALATE**
**ETHYL CHLORCARBONATE**
**ETHYL FORMATE**
**ETHYLENE**
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*Prepared Monthly by the U. S. Industrial Chemical Co., Inc.*

# SOLVENT NEWS

*Reg. U. S. Pat. Off.*

October ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1938

**Urethane—Ethyl Carbamate**

## Says Carbamates Improve Properties of Hair Dyes

WASHINGTON, D. C.—New hair dyeing assistants, described in a patent issued here, may make scores of dyes formerly regarded as unsatisfactory, perfectly suitable for dyeing human hair. Specific examples of the materials which are said to promote contact between dyes and the hair include: methyl-carbamate, phenyl carbamate and ethyl carbamate (urethane).

When urethane, for example, is used in proportions varying from 19 to 25%, dyes are said to adhere better, produce a faster and more permanent color on the hair, and may be used at a lower temperature. For blond hair the inventor suggests the following formula to be dissolved in 89 parts of water:

Urethane ..... 10 parts
Cupranil Brown (C.I. No. 560) .... 1 part

Among the scores of dyes which can be used in accordance with the invention are many which are in themselves non-irritating to the skin and non-poisonous to the human body, the inventor emphasizes.

**[Urethane is now available in limited quantities from small scale operation. Samples may be secured for experimental investigations from U.S.I.]**

## High Voltage Transforms Dibutyl Phthalate to Oil

ELIZABETH, N. J.—How dibutyl phthalate and other alcohols and esters may be transformed into an excellent lubricant by subjecting it to a high voltage electrical discharge is revealed in a patent granted two inventors here. The electrical discharge polymerizes the dibutyl phthalate and produces an unsaturated and unstable polymer which is stabilized by hydrogenation, according to the inventors.

They report that oils prepared by this process may be used directly as lubricants, or may be blended with other oils to improve the properties of the latter. In a specific example given in the patent, dibutyl phthalate was subjected to silent electric discharge at about 8,000 volts, 60 cycles, 5-20 mm. vacuum, and room temperature for several hundred hours. After this treatment, it was found that the viscosity at 100° F. had increased from 57.5 sec. to 167 sec. and the viscosity at 210° F. had gone from 34 sec. to 43 sec. The iodine number was found to be 11.3 and the acid number 29.72.

## Alcohol Aids Determination Of Trichlorethylene in Air

CAMBRIDGE, England—Ethyl alcohol is used for the rapid determination of trichlorethylene vapor in room air, in a new method described here. The trichlorethylene in a known volume of air is absorbed in a definite volume of alcohol through which the air is passed. An aliquot of the resulting solution is burned in a lamp and the vapors from the lamp are passed through a solution containing a known amount of silver nitrate which reacts with hydrochloric acid, etc. After absorption, the excess silver nitrate is titrated with potassium thiocyanate.

# Solox Lowers Cost and Speeds Production in Many Industries

### New Uses for U.S.I.'s General Solvent Include Manufacture of Special Lacquers, Varnishes, Adhesives, Cleaning Fluids, Etc.

Continuing its rapid expansion in diversified fields, Solox, U.S.I.'s proprietary alcohol-type solvent, made numerous gains on all fronts during the past few months. In addition to replacing other alcohol products in many long-established solvent uses, it won adoption in the manufacture of many new developments, ranging from dry cleaning fluids to adhesives for laminating metal foil to cellophane.

Solox consists essentially of 100 parts of S.D. alcohol No. 1, to which is added 5 parts of ethyl acetate and one part of aviation gasoline. Ethyl Acetate is a most effective organic solvent and has the unique property of bringing out the latent solvent power of the alcohol. It, therefore, not only contributes its own solvent power, but makes the mixture more efficient than either component alone.

**Aids Lacquer Formulation**

In the newer lacquer formulations, Solox has become a very important tool. For example, manufacturers of cellulose acetobutyrate lacquers have found ethylene dichloride and Solox to be one of the most useful solvent mixtures. Since the ethyl acetate in Solox is a solvent for cellulose acetobutyrate, the mixture has the virtues of economy and compatibility.

Recent studies have shown that 20% Solox with 80% toluol is one of the most powerful solvent combinations for ethyl cellulose. This mixture gives low viscosity solutions and superior final films.

Further illustration of the variety of formulations into which it has recently entered is the use of Solox in ethyl cellulose-Pontianak spirit varnishes. One reason for this application is the widespread use of Solox as a resin solvent.

Apart from the employment of Solox in ethyl cellulose lacquers is its use in ethyl cel-

*(Continued on next page)*

## U.S.I. Acquires Business of Stroock & Wittenberg Corp.

### Supplements Present Business In Resin Industry

U. S. Industrial Alcohol Co., which recently entered the synthetic resin industry, through the acquisition of the business of Robert Rauh, Inc., announces that it has supplemented this business by the acquisition of the business formerly conducted by Stroock & Wittenberg Corporation, consisting of selling natural and synthetic resins and importing natural resins.

The resin business of U. S. Industrial Alcohol Co. in its entirety will be conducted through a new corporation entitled "Stroock & Wittenberg Corporation" from the office of that Corporation at 17 Battery Place, New York City, under the personal direction of the Corporation's President, Mr. A. J. Wittenberg.

## Drug and Chemical Mfrs. To Meet October 21 and 22

The Drug, Chemical and Allied Trades Section of the New York Board of Trade will hold its Third Annual Fall Meeting and Gold Tournament on October 21st and 22nd, 1938. Complete details of the business and recreational activities are to be announced later. The meeting will be held at the Skytop Club, Skytop, Pennsylvania.

## U.S.I.'s General Solvent Enters New Fields

**CONVINCING PROOF of the superiority of Solox, U.S.I.'s proprietary solvent, over ordinary denatured alcohol is its rapidly expanding use in diversified commercial fields. Stronger solvent power, compatibility, and low cost are only some of the factors which lead Solox into the manufacture of so many recent developments, including new Lacquers, Varnishes, Adhesives, Cleaning Fluids, etc.**

ADVERTISEMENT—*This entire page is a paid advertisement.*



## Solox Cuts Cost and Speeds Production In Numerous Industries

*(Continued from previous page)*

lulose adhesives which promise to become important bonding materials. These quick-setting adhesives have already found many special applications, such as laminating paper, cloth, cellophane, cellulose acetate, metal foil to cellophane, etc.

Its solvent power and mild inoffensive odor make Solox the ideal solvent for cutting and thinning shellac. Where exceptionally smooth and lasting finishes are required, as for example, on bowling alleys, it is frequently specified exclusively.

### Non-corrosive Qualities

Principally because of its greater solvent power and non-corrosive qualities, Solox is the preferred solvent for cleaning watches, jewelry, electrical equipment, etc., and in dry cleaning fluids.

The non-corrosive properties of Solox have much to do with its application in two other fields. To prevent the formation of ice on airplane propellers practically all U. S. airlines specify a solution consisting of 15% glycerine dissolved in 85% Solox, which is fed from a reservoir tank into a small trough around the hub of the propeller.

Corrosion must also be guarded against in fluids for duplicating machines. Solox is used here to dissolve the aniline dye on the master copy.

In another comparatively new duplicating process, a solution of Solox and diethyl phthalate makes ordinary paper translucent for blue-printing. With this process any number of clear, distinct copies can be made at a cost much less than photostating.

### Excellent Fuel

Because Solox burns with a colorless flame, without objectionable odor and is clean and inexpensive, it is the preferred "alcohol-type" fuel for torches, chafing dishes, and portable stoves. One manufacturer of alcohol-burning torches and halide gas detectors recommends Solox exclusively for his equipment.

Anhydrous Solox continues to find increasing application both as a solvent and as a chemical. In many of the developments described above, as well as in older applications, water-free Solox is found to speed certain reactions and frequently to give higher yields. Because of its mild odor, Anhydrous Solox finds particular favor in products which must be applied in confined or public places.

Except for bulk shipments, no permit is required covering the sale of Solox for solvent and manufacturing purposes.

Other properties and applications of this outstanding solvent are described in a leaflet, "Solox, The General Solvent," available without charge from U.S.I.

## *Credit Acetic Acid With Toxic Effect On Molds*

Acetic and other innocuous fatty acids of this series have a remarkable toxic effect upon the growth of bread molds, it is revealed in a recent article. The pH must be kept low, however, since at pH values from 5.5 to 6.0 the acids have only a slight effect, the authors warn. It is believed that successful application of the principle to other than food or bakers' products is possible.

## Bactericidal Paints By Mixing Essential Oils?

The manufacture of bactericidal paints based on recent studies of the antiseptic value of combined essential oils, is under discussion in Italy, according to a recent report, Some time ago J. Risler, a German chemist, pointed out that mixing essential oils of different volatility lengthens their antiseptic value to about four years as compared with a few days when the oils are used separately. (See Alcohol News, July, 1937.) Italian paint chemists are now wondering whether adding some mixtures of essential oils might not lead to the development of new bactericidal paints, the report states.

## Hungry Little Yeasts

Specially selected yeasts used in the production of industrial alcohol from molasses have an enormous appetite. In two days the three tons of yeast in one large commercial fermenter, convert 75 tons of sugar. To equal this rate, a 140-pound man would consume about 1,750 pounds of sugar per day.

## TECHNICAL DEVELOPMENTS

*For further information, write to U.S.I.*

**A durable, water-repellent finish** for cotton, linen and rayon fabrics, reported recently, is said to resist frequent dry cleaning and laundering. Treated fabrics resist spotting and staining and are improved in appearance, drape and handle, the report states. **(No. 141)**

U S I

**A new insect repellent** having practically no odor is said to retain its effectiveness 2½ times as long as oil of citronella. In recent tests, the fluid repelled mosquitoes and house flies unfed for 24 hours, the manufacturer reports. **(No. 142)**

U S I

**A new automatic marker** is said to provide free flowing, smooth marking on packages, cartons, drums, paper, cloth, leather, etc. An indelible, waterproof and quick-drying ink is available, according to the manufacturer. **(No. 143)**

U S I

**A new wood filler** remains free to wipe 30 minutes after application and yet may be coated with sealer or shellac within two hours, according to the manufacturer. With this material, large pieces may be filled before the filler has dried too hard to wipe, it is claimed. **(No. 144)**

U S I

**Transparent cellulose acetate wrapping material** which generates much less static electricity than similar materials, was announced recently. According to the manufacturer, the material is proof against water, grease, dust and vermin, is unaffected by atmospheric changes and will not dry out with age. **(No. 145)**

U S I

**A new quick-drying primer** may be handled 3 minutes after application and recoated with a top coat within 10 minutes, the manufacturer reports. The primer is said to have exceptional rust inhibiting properties and to be especially suitable for hot- or cold-rolled steel, cadmium plating, zinc die castings, etc. **(No. 146)**

U S I

**A new water-white belt dressing** has neutral characteristics and contains only ingredients which pass U.S.P. standards, the manufacturer announces. **(No. 147)**

U S I

**Coloring and preserving concrete** by a new method is said to produce beautifully colored floors which are lime-proof, sun-resisting, oil-proof and generally stainproof. The system consists of a penetrating color and a dressing which fixes the dye, protects it from wear and produces the polish, a recent announcement states. **(No. 148)**

U S I

**For measuring particle sizes** below 325 mesh (44 microns), the device at left affords amazing accuracy as well as speed and ease of manipulation with low first cost, a recent announcement states. This particle size gives accurate results in about two hours from representative samples of less than five grams, the manufacturer maintains. **(No. 149)**


# U.S.I INDUSTRIAL ALCOHOL CO.
# INDUSTRIAL CHEMICAL CO. INC.

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C.P. 96%—Pure and Denatured
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Normal and Secondary

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# SOLVENT NEWS

*Reg. U.S. Pat. Off.*

November ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1938

## Expect New Textile Printing Process To Open Wide Markets

### Clear, Sharp Prints Obtained Easily by Fast *Aridye* Method

Further extensions of the *Aridye* textile printing process may lead to greatly increased use of prints, not only on cotton and rayons, but on woolens, worsteds, and the variety of fabrics composed in whole or part of rayon staple or other synthetics, executives of the Aridye Corporation said recently.

The *Aridye* process makes use of insoluble pigments of fine particle size uniformly dispersed in a vehicle in the form of a thin paste in which are incorporated certain water-insoluble binders.

Because of its wide divergence from established methods of printing, and because of the new and unusual color effects which have been obtained, the process has excited much comment in textile circles. It was first introduced about a year ago.

#### Fast to Light

*Aridye* prints are said to equal the best vat prints in being exceptionally fast to light and washing.

The compounds are applied on ordinary roller printing machines. Standard engravings are used but good results may also be obtained with relatively shallow engravings. Goods being run are dried and then cured by momentarily subjecting them to an elevated temperature to fix the colors and remove the solvent which is reported part of the compounds. Further after-treatment such as steaming, ageing or washing, is not necessary, it is said.

#### Mechanical Anchorage

In this brief treatment and simplification of the color preparation, textile men see many of the more important advantages of the process. *Aridye* prints in the final colors—anchorage to fibers is mechanical rather than chemical—and the time for taking patches is reduced, they point out. Streaks or imperfections are immediately visible to the printer, while elimination of ageing automatically prevents shading and tailing off.

Printers are said to be particularly impressed by the exceptionally clear prints and

(*Continued on next page*)

## *Says Moths Steer Clear Of Dimethylthianthrene*

WASHINGTON, D. C.—Furs, feathers or wool immersed in a solution consisting of 20 parts of dimethylthianthrene dissolved in 980 parts of alcohol will be immune from damage by moths, it is claimed in a new U. S. patent.

Other compounds of the thianthrene series which may also be used include thianthrene, dichlorodimethylthianthrene, thianthrene-S-oxide, the patentees state.

## "Azeotropic" Principle In Paint For Wet Metal

LONDON, England—An oil paint which "absorbs" water from any damp or wet metallic surface and which dries satisfactorily even in atmospheres continuously saturated with water vapor is described in a patent here.

One or more of the ingredients of the paint may be immiscible with water, the inventor explains, provided that two or more of the constituents of the whole mixture are capable of forming with water at least a ternary azeotropic mixture, i.e., a mixture of three liquids which has a lower boiling point than that of any of its individual ingredients.

#### Boils at 64.9°C

Cited in the patent as an example of a ternary azeotropic mixture to be used in such a paint is one containing 22.8 mol. per cent ethyl alcohol + 53.9 mol. per cent benzene + 23.3 mol. per cent water—the whole boiling at 64.9°C. When applied to a wet metal surface, the paint appears to absorb water, following which the azeotropic mixture of diluents and water forms and evaporates as a whole while the non-volatile part of the paint dries normally and without loss of adhesion to the "dewatered" surface.

The proper proportions of ethyl alcohol and benzene may be added to a paint consisting of linseed oil or tung oil or both in combination with selected resins and the desired pigments. The paint may contain, in addition, turpentine, solvent naptha, or mixtures of these, the inventor claims.

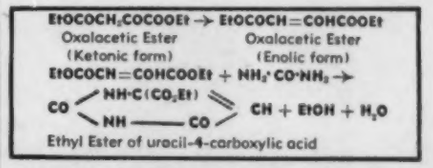
## Reactions of Sodium Ethyl Oxalacetate Point to New Uses

### Suggested Lines of Endeavor For U.S.I. Product Are Listed

Forecasts of several years ago that an unusual alcohol-derived chemical manufactured by U.S.I. would come into substantial use as chemists investigated its characteristics and working properties, are being fulfilled.

The chemical, Sodium Ethyl Oxalacetate, which has its principal use in the production of Tartrazine and other Pyrazolon dyestuffs has entered into a number of new fields. A measure of its greater employment is its price which currently is approximately 30% less than five years ago.

However, many chemists believe that the full possibilities of Sodium Ethyl Oxalacetate




**OXALACETIC ESTER, easily prepared from Sodium Ethyl Oxalacetate by adding HCl, condenses with urea, both amino groups taking part in the reaction. The resultant product, uracil-4-carboxylic acid, melts at 347°C. and is extremely stable to sulphuric and nitric acids.**

are yet to be explored. A citation of some typical reactions listed in the U.S.I. catalog, *Solvents and Chemicals*, shows a few suggested lines of endeavour:

(1) Manufacture of Tartrazine dyes.
(2) This ester adds on to ammonia and to many primary and secondary amines. The resultant products soon go over into the amines of oxalocitric acid lactone ester.
(3) If aldehydes are present when certain amines are condensed with oxalacetic ester, keto-pyrollidon carboxyllic acids are formed.
(4) In the presence of pyridine, ethyl oxal-

(*Continued on next page*)

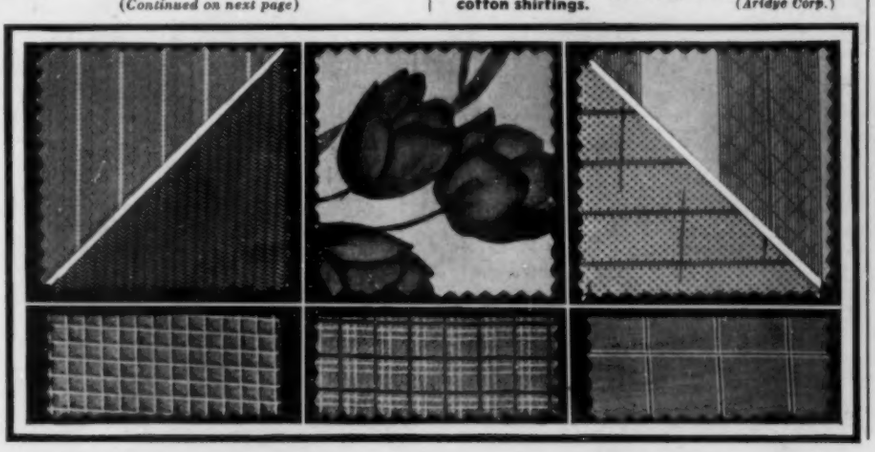
## Vitamin A Relieves Eyes, Improves Color Matching

MANSFIELD, Ohio—How Vitamin A can improve color matching efficiency, relieve eye fatigue and improve the general health of certain types of industrial workers is revealed by two eye specialists here.

Observations on a group of inspectors matching colors on a production line convinced the experimenters that the men were not regenerating their "visual purple" fast enough. (Visual purple is a substance in the retina of the eye closely connected with the process of seeing, particularly colors.) Knowing that the body's process of producing visual purple requires the presence of Vitamin A, the doctors prescribed three 10,000-unit capsules of carotene-in-oil daily.

At the end of seven months the specialists reported an increase in the regeneration of visual purple from 50 to 100%; more than 75% improvement in color matching efficiency, and an appreciable improvement in health, particularly where fatigue, headache and eyestrain formerly were chronic.

**UNIFORM COLORATION on all fibers and fiber mixtures (including fibrous glass) is claimed for the new Aridye method of textile printing which bears great similarity to letter-press paper printing. Below are sample cotton shirtings.** (*Aridye Corp.*)



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November ★ **SOLVENT NEWS** ★ 1938

## Inventors Claim New Paint Takes Polish After Drying Dull

MILWAUKEE, Wisc.—Two inventors here claim they have produced a paint which may be polished from a flat surface to a semi-gloss by rubbing or brushing, after the paint has dried to a point at which it has lost its sheen.

The polishing process, they say, can be used to produce designs on the painted surface. After thoroughly hardening, the paint can be washed or scrubbed without further polishing or without removing the design, the patent states.

A paint prepared according to their invention contains as an essential component a wax of the class of animal or vegetable waxes. In a typical formula cited, the following proportions by weight are used:

| | Per Cent |
|---|---|
| Lithopone | 61.5 |
| Aluminum silicate | 8.8 |
| Beeswax | 0.4 |
| Flatting varnish | 20.1 |
| Linseed oil (cooked) | 9.2 |
| | 100.0 |

The maximum quantity of wax which can be employed without impairing drying or other properties is one half of one per cent, the inventors state. Below this, however, it improves the washability, they hold.

## New Markets For Sodium Ethyl Oxalacetate Seen

(*Continued from previous page*)

acetate and ethyl cyanacetate form triethyl cyanaconitate.

(5) With hydrochloric acid, oxalacetic ester is converted into derivatives of alpha pyrone.

(6) Oxalacetic ester is unstable, and on heating to 150°C. for four hours oxalocitric acid lactone is formed. Dilute potassium carbonate precipitates the stable potassium salt of oxalacetic ester.

(7) Oxalacetic acid is reduced by yeast to malic acid (Chem. Abs. 25. 4898).

(8) In the presence of pyridine or diethyl amine, 2 molecules of oxalacetic ester condense with one molecule of an acyclic aldehyde.

(9) Acetic anhydride and oxalacetic ester form acetoxyfumaric acid diethyl ester.

(10) Heated to 150-350°C., oxalacetic ester loses carbon monoxide and form diethyl malonate. (British Patent 228,863.)

Unlike the ethyl ester from which it is prepared, Sodium Ethyl Oxalacetate is quite stable and entirely suitable for uses where the ester might be employed.

## Says Paint Sprayed Hot Will Resist Corrosion

LONDON, England — Hot spray-painting with a new type of gun has certain characteristics which are particularly advantageous on metals exposed to moisture, according to a report published here. No primer of lead is required and the method results in a dense, enamel-like coating which resists corrosion, the author asserts.

Paint, consisting of resin, wax, white zinc and graphite is liquified in an electrically heated reservoir and carried by compressed air to an ordinary paint spray cap in the nozzle of the gun. Flame from a compressed gas burner which surrounds this nozzle is said to warm and dry the surface while the paint is being applied.

## Textiles Printed Like Paper In New Process

(*Continued from previous page*)

sharpness of fine lines on shirtings which are said to be possible with *Aridye* printing.

Although progress with the *Aridyes* during the past year has been swift, informed textile quarters believe the full impact of the process has not yet been felt. In support of this assertion, may be quoted a leading authority, *The Textile World*, which has this comment to make:

"There is a natural tendency to look at the *Aridyes* and the vat colors as being competitive, since they are more or less comparable from the standpoint of fastness properties and coats; but the extent to which the new process will replace vat printing is problematical. It would not be surprising, in fact, if in the long run the *Aridye* colors find their widest use, not as substitutes for the older classes of dyes, but in entirely new applications. [They] may prove to be the most important development in textile printing since the introduction of vat and naphthol colors and their derivatives."

### Liquid Metal Polish

A formula for a liquid metal polish developed in Germany is given as follows: Dissolve 8 parts of fatty acids in 15 parts of denatured alcohol, saponify with 4 parts of ammonia (sp. gr. 0.91), add 2 parts of fatty alcohol sulfates, dissolve in 58 parts of benzine and stir the solution with 50 parts of fine Neuburger chalk.

## TECHNICAL DEVELOPMENTS

*Further information on these items may be obtained by writing to U.S.I.*

**An antiseptic 91,000 times as bactericidal as carbolic acid** and 1,300 times as potent as bichloride of mercury when tested against a variety of spore forming and non-spore forming organisms, has been introduced. It is odorless and colorless, an announcement continues, and is sufficiently non-irritating for use in cosmetics. **(No. 151)**

U S I.

**A process to give "wet-strength" to paper,** enabling it to resist the disintegrating effect of water, has successfully been applied to paper towels, according to a recent announcement. The relatively inexpensive process is said to keep the towels from tearing and "pulping" in use. **(No. 152)**

U S I.

**A cedar-wood oil concentrate** said to be particularly adaptable to termite-proofing formulas, is now available. It can be mixed with kerosene and paradichlorobenzene and will provide a weatherproof, protective film against rot and mold, the manufacturer claims. **(No. 153)**

U S I.

**A new plastic coating** applied to metal, glass, wood, and molded products by dipping or spraying is claimed to be superior to plating in acid resistance, salt spray, abrasion, and aging tests. According to the manufacturer, coatings from 0.003 in. to 0.10 in. thick may be applied in a variety of colors and textures. It is said to air-dry quickly to a smooth, lustrous surface. **(No. 154)**

U S I.

**New diffusion pumps** capable of producing vacuums of one/ten millionth m.m. at speeds of approximately 1,000 liters of gas per second, were announced recently. Employing a beam of special oil vapor in place of a rotary propellor, the pumps are reasonably priced, the manufacturer reports. **(No. 155)**

U S I.

**For finishing creosote-treated wood surfaces,** a new paint is said to form an effective seal against pitch and creosote. The hard, bright finish resists abrasion and is impervious to oils and dilute acids, according to the manufacturer. **(No. 156)**

U S I.

**A new lacquer** for spray application is said to air-dry to a decorative crystal design variable by adjustment of the spray gun. It is suitable, according to the manufacturer, for application on metallic and non-metallic surfaces, both porous and smooth. **(No. 157)**

U S I.

**A white emulsion furniture polish** now available for bottling under private label, gives a dry, non-greasy finish without hard rubbing, according to a recent announcement. The manufacturers state that the product does not separate after standing and is suitable for painted, varnished or lacquered woodwork. **(No. 158)**


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**DIETHYL CARBONATE**

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**ISOPROPYL ACETATE**
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**ETHYL ACETOACETATE**
**SODIUM ETHYL OXALACETATE**
**PARACHLOR-O-NITRANILINE**

**ACETONE**
**DIBUTYL OXALATE**
**DIETHYL OXALATE**
**ETHYL CHLORCARBONATE**
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# SOLVENT NEWS

*Reg. U. S. Pat. Off.*

December ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1938

## Pictures Brick and Stucco Dwellings As Vast Paint Market

### Gardner Says 38 Million Such Houses Need 400,000,000 Gals.

ATLANTIC CITY, N. J.—A potential market for more than 400,000,000 gallons of paint exists if all the brick and stucco dwellings in this country are to be painted, it was asserted here recently by Dr. H. A. Gardner.

Speaking before the national convention of the National Paint, Varnish and Lacquer Ass'n., Dr. Gardner cited figures showing that there are upward of 38 million dwelling units of this type in the U. S. and that an average of 10 gallons of paint is needed for the interior and exterior of each dwelling.

**Other Structures Triple Market**

For every 100 million gallons of paint used to decorate dwellings, there is surely a market of at least 300 million gallons to decorate and protect other types of brick and stucco structures, Dr. Gardner indicated.

Paint properly applied, Dr. Gardner said, can be used to close the pores and capillary tubes in brick and mortar joints, thus eliminating dampness and wall discoloration. Paint also will make interiors as much as 10 degrees cooler in summer, he continued.

Newly devised resinous emulsion paints for brick are making considerable headway, it was stated.

## Says "Starchless" Collars Won't Wilt Below 300° F.

NEW YORK, N. Y.—Fabrics laminated with a thermoplastic adhesive recently patented by an inventor here are described as "flexibly stiff" and particularly suitable for starch-less collars, cuffs and shirt bosoms.

A preferred formula for the adhesive is given in the patent paper as:

| | |
|---|---|
| Polymerized derivative of methacrylic acid | 100 pts. by wt. |
| Dibutyl phthalate (or other plasticizer) | 10 |
| Chlorinated rubber | 10 to 40 |

Such an adhesive, the inventor claims, has a melting point above 300° F. and maintains its adhesive qualities below 212° F. Therefore, he points out, it is ideally suited to normal washing and ironing temperatures and is not affected by body heat.

## Special Label Adhesive Formulated With Solox

BROOKLYN, N. Y.—Answering an inquiry for a label adhesive which dries on the labels yet is sufficiently thermoplastic to permit application to cartons with a hot iron, the American Gum Importers' Ass'n. recommends the following formulation in one of its recent publications:

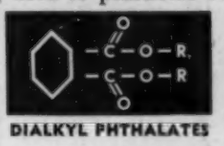
| | Parts by weight |
|---|---|
| Ethyl Cellulose (low viscosity) | 20 |
| Batavia Damar A/E | 40 |
| Paraffin | 2 |
| Toluol | 116 |
| SOLOX | 14.5 |
| Butyl Acetate | 14.5 |

SOLOX is the proprietary solvent manufactured by the U. S. Industrial Alcohol Co.

# Unusual New Applications Prove Versatility of Dialkyl Phthalates

### Improved Quality of U.S.I. Phthalate Plasticizers Lead to Use In New Surface Coatings, Adhesives, Lubricants, etc.

Names like nitrostarch, methyl methacrylate and polyvinyl acetate are cropping up in today's discussions of new uses for the dialkyl phthalates. Lacquer chemists hear of diamyl phthalate being used to plasticize complex ester gum-wax-crepe rubber compositions. A recent patent reveals dibutyl phthalate in vinyl chloride-vinyl acetate - chlorinated rubber adhesives.



DIALKYL PHTHALATES

Diethyl and dimethyl phthalates have cellulose acetobutyrate, cellulose acetopropionate, and ethyl cellulose added to their already established applications.

**Low Vapor Pressure**

These and a wealth of other examples emphasize the swiftly growing importance of the dialkyl phthalates. Actually, they are among the best known and most widely used agents for softening and imparting flexibility to lacquer films.

The reasons are not hard to find. Low vapor pressure and good retentivity in lacquer films, compatibility with an unusually wide range of lacquer constituents, stability to light, water-white color, lack of odor, and non-toxic character are properties which each of these solvent plasticizers has in a large degree.

**Virtually Chemically Pure**

The U. S. Industrial Chemical Co., Inc., was responsible for the introduction of diamyl phthalate and has long been one of the foremost producers of dibutyl, diethyl and dimethyl phthlates. U.S.I. has consistently improved the quality of the dialkyl phthalates and current production with improved equipment provides materials which are virtually chemically pure.

A number of relatively new applications for dibutyl phthalate center about ethyl cellulose. Films of ethyl cellulose retain their toughness and flexibility under conditions of severe aging when plasticized with even as little as 2 to 5% of dibutyl phthalate. This is particularly true in ethyl cellulose-phenolic resin lacquers. For ethyl cellulose adhesives, diamyl, diethyl and dimethyl phthalates have been found equally applicable, In chlorinated rubber, as well as in methyl methacrylate and in

(*Continued on next page*)

## A. F. Wortman, Webb Sales Manager, to Retire Jan. 1

NEW YORK—Rounding out a record of 51 years of service that is probably without parallel in the industrial alcohol industry, A. F. Wortman, sales manager of James A. Webb and Son, Inc., a division of U.S.I., retires on January 1. For over a century James A. Webb and Son have been supplying the famous "Webb" brand of pure alcohol to hospitals, and perfume and flavoring extract manufacturers.

A. F. WORTMAN

**Began in 1888**

"Gus," as he is known to thousands of alcohol buyers, completes a career that, incredible as it may seem, began on January 2, 1888 with the old firm of James A. Webb and Son at 165 Pearl Street. The Webb company was founded in 1835.

In 1920, five years after James A. Webb and Son had been acquired by the U. S. Industrial Alcohol Co., Mr. Wortman was made manager of the Webb company. He also served as assistant secretary and assistant treasurer of the parent company.

Mr. Wortman's departure is regretted by his host of friends, but those who know him best have a suspicion that "Gus" is going to welcome the extra time he will be able to give his favorite recreations of bowling, bridge, dancing and the Knickerbocker Field Club.

## Explains How They Make Leather That "Breathes"

LONDON, England—How sheets of respirable artificial leather can be made by compressing impregnated vegetable fibres is revealed in a patent granted here. Dry, loosely fluffed layers of such fibres as cotton, linen, hennequin, sisal, hemp and wood or rag pulp are impregnated with a latex binder and compressed in successive steps, according to the patent.

Glue, ammonia or volatile organic liquid and formaldehyde may be added to the binder.

The preferred organic liquid consists of ethyl alcohol, methyl alcohol, acetone, ethyl acetate and gasoline. The alcohol and gasoline are added to the latex-glue mixture just before spraying. Fish, hide, casein, blood or egg albumen glues may be used.

### New Insecticide Concentrate

A new Derris concentrate (with or without rotenone) suitable for use in kerosene type contact insecticides, is now available. By the use of this concentrate, savings up to 60% in the cost of active ingredients are claimed.

## Says Chemical Graining Improves Litho Plates

WASHINGTON, D. C.—For cleaning lithographic printing plates preparatory to a method of chemical graining, a solution containing phosphoric acid, butyl alcohol and sulphonated lorol should be used to remove grease and other deposits, according to a patent issued here.

After cleaning, the zinc plates are immersed in a special, hydrolyzable acid phosphate solution for about 30 minutes and then rinsed. Chemically grained plates, the inventor declares, allow a finer screen to be used and are capable of supplying more prints.

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December ★ **SOLVENT NEWS** ★ 1938

## New Starch Purifying Process Removes Even Difficult Impurities

MADISON, Wisc.—A method of starch purification which, in its final stages, permits dilute alcohol solutions of the starch polysaccharide to be directly hydrolyzed for the production of syrups and crystalline products has been developed here, according to a patent just assigned to the Wisconsin Alumni Research Foundation.

The process, it is asserted, removes known impurities such as ash constituents, lipoids, non-starch polysaccharides, pentosans, and nitrogenous compounds which orthodox methods of refining leave behind.

**Use Ethyl Alcohol**

To accomplish this purpose, the inventors treat starchy masses with a solution of 1.0% nitric acid in 85% ethyl alcohol which, by its differential actions of oxidation, substitution and hydrolysis, takes into solution part of the impurities, while converting others into insoluble form.

It is said that from 10 to 30 minutes is ample for the treatment. As an alternative solution, 4.0% free chlorine in 95% ethyl alcohol may be used.

## Name 4 Most Promising Wood Decay Preventives

PORTLAND, Ore.—Of the 25 chemicals and proprietaries studied as wood preservatives, the four most promising are pentachlorophenol, *o*-phenylphenol, 2-chloro-*o*-phenylphenol, and tetra-chlorophenol, according to the Western Pine Association.

The preservatives were evaluated for toxicity, volatility, leaching by water and 10 other factors. The fungus most commonly producing decay was identified as *Lenzites trabea.*

## *5,000 Year Inks*

In 6938 A.D., the "super-permanent" red and black inks developed by a large printing ink company to print the "Book of Record" of the New York World's Fair will still be readable, authorities claim.

Chemists in 1938 may be interested in the composition of these inks, reported as follows: (Black) carbon black toned with Syan Blue B (copper phthalocyanine) and (Red) diazotized 5-chloro-ortho-toluidine with beta hydroxynaphthoic-5-chloro-ortho-toluidine.

## *Better Mildew-Proofing With Alcohol Solution*

Mold growth was attacked on two fronts recently. First, a Danish inventor reports that treatment with calcium propionate prevents mold growth on food-stuffs and water-proof oiled paper. Second, an author in this country states that phenyl mercuric nitrate gives better mildew-proofing when dissolved in warm alcohol instead of water.

## New Applications Prove Phthalates' Versatility

(*Continued from preceding page*)

nitrostarch, dibutyl phthalate is one of the useful plasticizers.

Diamyl phthalate, which because of its low vapor pressure and narrow viscosity range has been utilized to replace mercury in vacuum pumps, is specified in a recent patent as a plasticizer for paper coatings consisting of resins, crepe rubber and wax. Along with the three other phthalates, it is now accepted as a good plasticizer for cellulose acetobutyrate. It is also formulated in rubber cements.

**In Cellulose Acetobutyrate**

The combination of diamyl and dibutyl phthalates is finding increasing use as a plasticizer in nitrocellulose lacquers for paper and artificial leather, which demand unusually high flexibility. Both phthalates may be employed to plasticize cellulose acetopropionate.

Dimethyl and diethyl phthalates are today virtually the most widely used plasticizers for cellulose acetate. However, both products have other novel applications, some of which may become more significant. Diethyl phthalate, dissolved in SOLOX,* has a transparentizing effect on paper. Diethyl phthalate is a recognized fixative for perfumes, as well as an authorized denaturant for specially denatured alcohol formulas 39B and 39C.

**Oil From Dibutyl Phthalate**

Among chemical applications for the dialkyl phthalates is the conversion (by high voltage polymerization) of dibutyl phthalate into a useful lubricant. The hydrogenation of the phthalates into dialkyl hexahydrophthalates, useful as intermediates, is described in another recent patent.

U.S.I. welcomes the opportunity to give responsible manufacturers more detailed information regarding particular applications for dialkyl phthalates.

*Trademark registered.

## TECHNICAL DEVELOPMENTS

*Further information on these items may be obtained by writing to U.S.I.*

**A fire-resistant plastic paint** with a resin base withstands an 1800° F. Bunsen burner flame for 5 minutes without disintegrating, it is claimed. It may be applied by spraying or brushing and is said to be suitable for exterior use and particularly for plywood surfaces. **(No. 160)**

U S I

**A new metallic soap** yields concentrated aluminum stearate dispersions of very low viscosity, according to an announcement. Dispersions in solvents and oils can be diluted, have high penetration, and are particularly effective for waterproofing fibrous or porous materials, the manufacturer states. **(No. 161)**

U S I

**New whiting,** said to consist of particles of rounded shape and a large percentage of sizes within the colloid range, is now on the market. Suggested applications include: rubber filler, oil putties, oil paints and low-cost enamels, and in calcimines. **(No. 162)**

U S I

**An all-purpose label adhesive** capable of adhering to practically any surface has been announced. The manufacturer declares the product has received exhaustive tests under many temperature and humidity conditions. **(No. 163)**

U S I

**A new electric painting machine** is said to spread paint by centrifugal force in an even, fan-shaped stream from 1 to 18 in. wide without spattering or fogging. Speeds up to 1,500 sq. ft. per hour, five times faster than brushing, are claimed.

U S I **(No. 164)**

**Concentrated water repellent preparations** can be produced from two new aluminum salts which contain upwards of 35% active aluminum oxide, according to a recent report. Both salts are said to be readily soluble in water to give solutions ranging from 4.7 to 5.4 pH. **(No. 165)**

U S I

**For writing on glass or enameled ware** an ink described as non-corrosive, non-inflammable, and resistant to common organic solvents has been developed. The manufacturer states it is available in white or black, and, whether applied with pen or brush, has good permanence. **(No. 166)**

U S I

**A new preservative** designed to replace benzoic acid, sodium benzoate or salicylic acid is said to be more effective in acid, alkaline or neutral conditions. It is described as a white, odorless, stable, non-toxic powder readily soluble in alcohol and in water. **(No. 167)** U S I

**Elimination of smoke, soot and sludge,** as well as lowering of fuel costs, is claimed for a new liquid "oil conditioner" for Bunker "C" No. 6 Fuel Oil. Addition of 1 gallon of the liquid to 2,000 gallons of fuel oil is also said to reduce maintenance costs and cause the burner to start more quickly.

U S I **(No. 168)**

**A pH indicator chart** printed in 14 colors is now available free of charge, upon written request, according to a recent announcement. The charts are designed to be used with new wide-range (pH 1 to 14) indicator paper. **Solvent News** will be glad to forward inquiries to the proper source. **(No. 169)**


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Normal and Secondary
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85-88%, 95-98%, 99% and U.S.P

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**ETHYL FORMATE**
**ETHYLENE**
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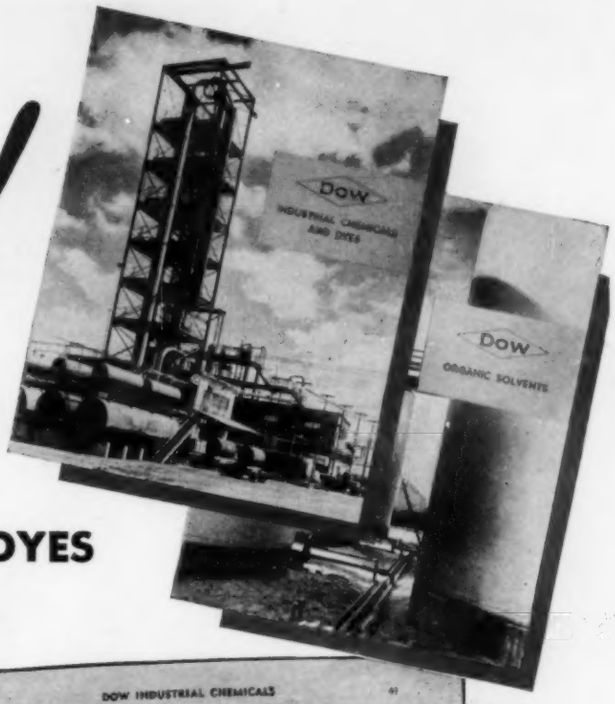
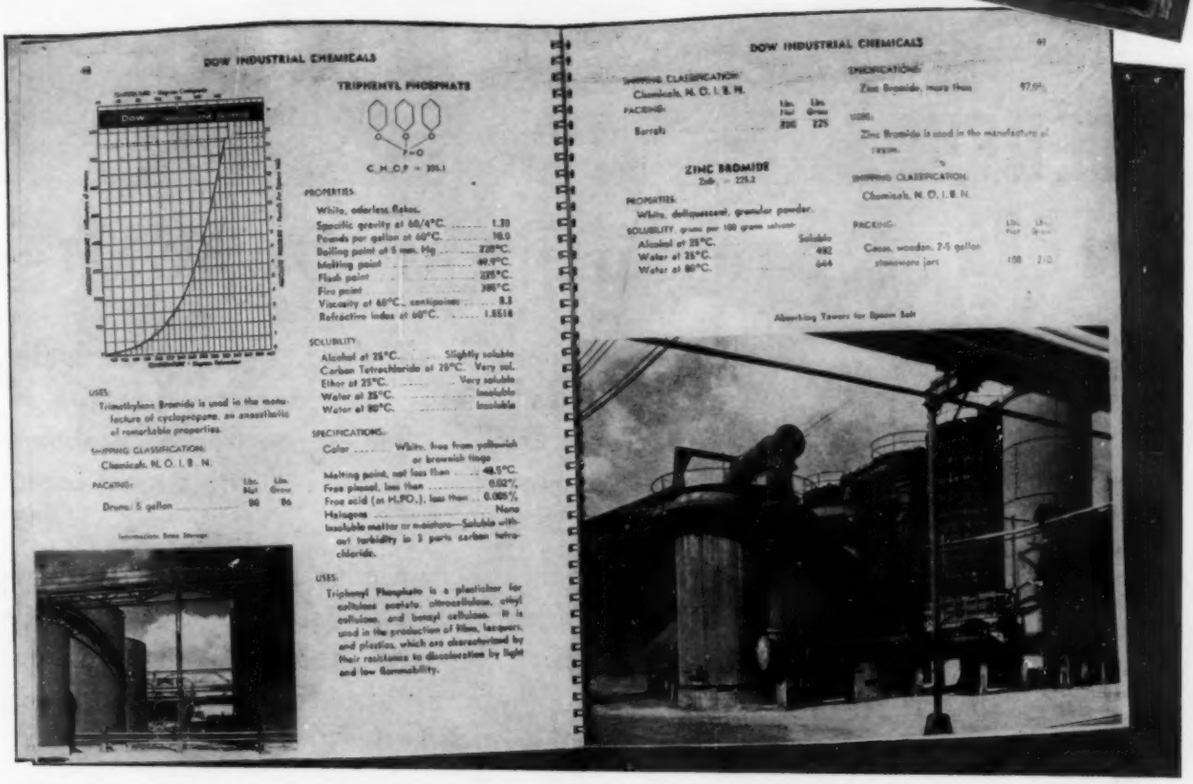



## TWO NEW DOW CATALOGS

## INDUSTRIAL CHEMICALS AND DYES *and* ORGANIC SOLVENTS


DOW INDUSTRIAL CHEMICALS
TRIPHENYL PHOSPHATE
PROPERTIES:
White, odorless flakes.
Specific gravity at 60/4°C. ..... 1.30
Pounds per gallon at 60°C. ..... 10.8
Boiling point at 5 mm. Hg ..... 220°C.
Melting point ..... 49.9°C.
Flash point ..... 225°C.
Fire point ..... 390°C.
Viscosity at 60°C., centipoises ..... 8.3
Refractive index at 60°C. ..... 1.5516
SOLUBILITY:
Alcohol at 25°C. ..... Slightly soluble
Carbon Tetrachloride at 25°C. Very sol.
Ether at 25°C. ..... Very soluble
Water at 25°C. ..... Insoluble
Water at 80°C. ..... Insoluble
SPECIFICATIONS:
Color ..... White, free from yellowish or brownish tinge
Melting point, not less than ..... 48.5°C.
Free phenol, less than ..... 0.02%
Free acid (as $H_3PO_4$), less than ... 0.005%
Halogens ..... None
Insoluble matter or moisture—Soluble without turbidity in 3 parts carbon tetrachloride.
USES:
Triphenyl Phosphate is a plasticizer for cellulose acetate, nitrocellulose, ethyl cellulose, and benzyl cellulose. It is used in the production of films, lacquers, and plastics, which are characterized by their resistance to discoloration by light and low flammability.
DOW INDUSTRIAL CHEMICALS
ZINC BROMIDE
PROPERTIES:
White, deliquescent, granular powder.
SOLUBILITY, grams per 100 grams solvent:
Alcohol at 25°C. ..... Soluble
Water at 25°C. ..... 482
Water at 80°C. ..... 664
SHIPPING CLASSIFICATION:
Chemicals, N. O. I. B. N.
PACKING:
Barrels ..... 200 lbs. net, 225 lbs. gross
Cases, wooden, 2-5 gallon stoneware jars ..... 100 lbs. net, 210 lbs. gross
SPECIFICATIONS:
Zinc Bromide, more than ..... 97.0%
USES:
Zinc Bromide is used in the manufacture of photographic film.
SHIPPING CLASSIFICATION:
Chemicals, N. O. I. B. N.
Absorbing Towers for Epsom Salt

These two completely new Dow catalogs contain a large amount of selected technical information that is invaluable to every buyer and user of chemicals.

Included in the data are over fifty curves and a series of tables summarizing the properties of one hundred and twenty products. The information in these catalogs is carefully arranged for the convenience of the user. Much of the data is not available elsewhere.

Send for your copies of these new Dow catalogs today.

THE DOW CHEMICAL CO., MIDLAND, MICH.

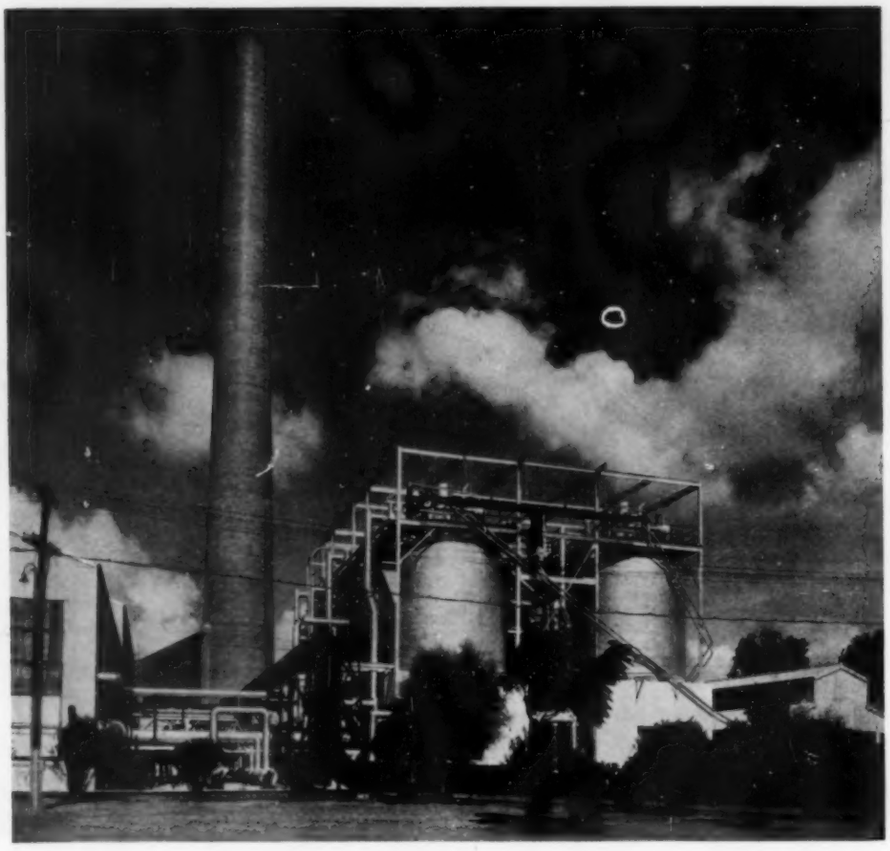
*Branch Sales Offices: 30 Rockefeller Plaza, New York City • Second and Madison Streets, St. Louis • Field Building, Chicago • 1400 16th Street, San Francisco • 2260 East 15th Street, Los Angeles*

TRADE DOW MARK

Reg. U. S. Pat. Off.

**CHEMICALS INDISPENSABLE TO INDUSTRY**

Sulphur Service



# SOFTENED WATER....for Sulphur Deposits

MILLIONS of gallons of softened, superheated water are forced daily into the extensive deposits of Sulphur of the Texas Gulf Sulphur Co. to free and recover from the depths of the earth one of industry's most useful elements.

Many products, by their very names, suggest the importance of Sulphur. Sulphuric acid, sulphur dyes, sulphur plastics, sulphanilamide (a new medicine), sulphite and sulphate pulps . . . these are but a few of the many and the list is steadily growing.

Industry needs Sulphur. Texas Gulf maintains full service for this important element.

TEXAS GULF SULPHUR CO.
75 E. 45th Street New York City
Mines: Newgulf and Long Point, Texas

# INFORMATION

*about*

# Du Pont Methacrylate Resins

## ...properties of Methacrylic Ester Polymers

| PROPERTY | METHYL | ETHYL | NORMAL PROPYL | NORMAL BUTYL | ISOBUTYL |
|---|---|---|---|---|---|
| Density—25°C..... | 1.19 | 1.11 | 1.06 | 1.05 | 1.02 |
| Hardness (Pfund)* G. at 25°C..... | 220 | 141 | 100 | 1 | 210 |
| Thermal Yield Point**, °C..... | 125 | 65 | 38 | 30 | 70 |
| Tensile Strength lbs./sq.in..... | 9,000 | 5,000 | 4,000 | 1,000 | 3,400 |
| Impact Strength (Dynstat)***Kg.Cm./Cm.$^2$ | 10.5 | 7.1 | 6.5 | 11.5 | 1.6 |
| Refractive Index..... | 1.490 | 1.485 | 1.484 | 1.483 | 1.477 |
| Extensibility—5 mil. films (% at break).. | 4 | 7 | 5 | 230 | 2 |
| Toughness****..... | 98 | 174 | 76 | 1,000 | 23 |

*Gardner, "Physical and Chemical Examination of Paints, Varnishes, Lacquers, Colors."

**Thermal Yield Point is not the softening temperature. It designates the temperature to which a thin bar of the resin 3" x 3/8" x 3/16" can be heated before it will remain bent after a moderate mechanical stress has been applied. The softening temperature determined by the ball and ring method or the capillary tube method would give much higher readings.

***Instruments, Vol. 9, 218 (1936)

****Area under load-elongation curves, expressed in arbitrary units.

## GENERAL PROPERTIES

**TRANSPARENCY:** water-white and transparent. Thin coatings on polished metals are nearly invisible.

**STABILITY:** stable to light and aging, and will not yellow under direct sunlight or ultra-violet.

**SOLUBILITY:** all are soluble in esters, ketones, aromatic hydrocarbons, and chlorinated hydrocarbons. The isobutyl and normal butyl methacrylate polymers are soluble in petroleum solvents.

**PLASTICIZER COMPATIBILITY:** compatible with phthalate, phosphate, and other commercial plasticizers.

**RESIN COMPATIBILITY:** compatible with many natural and synthetic resins.

**PIGMENTATION AND DYEING:** can be pigmented, or dyed to produce colored transparent coatings.

**WEATHERING CHARACTERISTICS:** excellent weathering resistance shown on tests conducted in Florida as metal coating compositions.

**ELECTRICAL PROPERTIES:** dielectric strength is uniformly good. Arc resistance is outstanding.

**ADHESIVE PROPERTIES:** strong adhesive properties and can be used as coatings or adhesives on metal, cloth and paper.

**CHEMICAL RESISTANCE:** resistant to aqueous solutions of inorganic reagents, such as 35% sulfuric acid, 25% hydrochloric acid, 60% phosphoric, aqua ammonia and 20% sodium hydroxide.

DU PONT

**E. I. DU PONT DE NEMOURS & COMPANY, INC.**

**AMMONIA DEPARTMENT WILMINGTON, DELAWARE**

J & L

CXP

TRADE MARK

BENZOL

**has these exclusive features which increase your production, cut processing costs and assure you a better product**

Here is a Benzol completely free of corrosive compounds — that will keep your stills running on a continuous maximum production basis — with fewer shut-downs for cleaning.

J & L CXP Benzol is made by an exclusive process giving it a high degree of purity that marks it as one of the outstanding chemical achievements of the day.

You are assured better distilling operations, lower operating costs and increased production by using J & L CXP Benzol — always uniform and always consistent.

J & L CXP Benzol has the following critical properties guaranteed — Freezing Point 5.30° C — Boiling Range, less than 1°C — Bromine Index 3.

Write us on your letterhead and we shall be glad to send you a free sample of J & L CXP Benzol.

J&L STEEL

J & L—ALWAYS MAKING FINER STEELS FOR NEW AND BETTER USES

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS

PITTSBURGH, PENNSYLVANIA

MAKERS OF HIGH QUALITY IRON AND STEEL PRODUCTS SINCE 1850

PHOSPHORUS PENTOXIDE

$P_2O_5$

(*anhydrous*)

. . . IN VARIOUS FORMS OF DIFFERING APPARENT DENSITY TO CONFORM TO THE REQUIREMENTS OF DIFFERENT APPLICATIONS

. . . IN TINS OR FULL OPEN HEAD STEEL DRUMS

. . . BACKED BY MANY YEARS OF EXPERIENCE IN MANUFACTURE, HANDLING AND APPLICATION.

CONSULT US IN REGARD TO YOUR REQUIREMENTS.

OLDBURY ELECTRO-CHEMICAL COMPANY

*Plant and Main Office:*

NIAGARA FALLS, NEW YORK

*New York Office:*

22 EAST 40TH ST., NEW YORK CITY

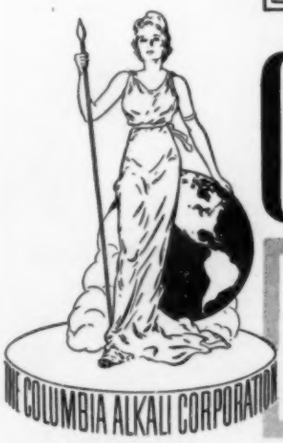
*Phosphorus and phosphorus products. Sodium chlorate. Potassium perchlorate. Oxalic acid.*

*Recent Air View of Barberton Plant,* THE COLUMBIA ALKALI CORPORATION

*Through The Centuries With Alkalies...*

TWENTIETH CENTURY

**IN this concluding chapter of a series tracing the part which alkalies have played through the ages in the development of many industries, it seems fitting to picture the present Barberton plant of THE COLUMBIA ALKALI CORPORATION as an example of current achievement in alkali production. Here modern science has made possible the manufacture of Soda Ash, Caustic Soda, Sodium Bicarbonate, Modified Sodas, Liquid Chlorine and Calcium Chloride in quantities and quality undreamed of a few decades ago.**




# COLUMBIA

SODA ASH
CAUSTIC SODA
SODIUM BICARBONATE
MODIFIED SODAS
LIQUID CHLORINE
CALCIUM CHLORIDE

**THE COLUMBIA ALKALI CORPORATION**
BARBERTON • OHIO

NEW YORK
ST. LOUIS
CLEVELAND
CHICAGO
PITTSBURGH
MINNEAPOLIS
BOSTON
CINCINNATI
PHILADELPHIA

Not so many years ago, the manufacture of glass was an art that had changed little since the building of the pyramids. It was not until modern chemists and physicists took a hand that glass became the miracle product we know today.

Now there is a special glass for almost every purpose . . . a more perfect glass for lenses; another glass for insulating elusive high frequency electrical currents; a heat-retarding glass for making building bricks; a non-splinterable glass for windshields; delicately beautiful glass threads that are spun into cloth; a glass that will withstand quick changes in temperature.

Among the influences that helped bring about this great advance in glass manufacturing methods *was the invention of the Solvay Process**. This "key process," introduced into America in 1881, made Soda Ash and Potassium Carbonate (essentials in the manufacture of glass) available in large quantities, in pure grades, at low cost.

The marked impetus given the modern glass industry by the development of the Solvay Process is typical of the effect its advent had on a wide diversity of industries. This Process enabled these industries to improve and reduce the cost of their products . . . to make possible a wider distribution of necessities.

Solvay leadership, first evidenced in the introduction of this important Process, is also clearly evident today. By providing the most advanced, comprehensive service facilities along with the most extensive alkali manufacturing equipment in America, Solvay assures its customers of adequate supplies of alkalies as well as the benefits of its broad knowledge in their use and handling.

**SOLVAY SALES CORPORATION**

*Alkalies and Chemical Products Manufactured by The Solvay Process Company*

**40 RECTOR STREET NEW YORK, N. Y.**

*Branch Sales Offices:*

Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, New Orleans, New York, Philadelphia, Pittsburgh, St. Louis, Syracuse

** The Solvay Process employs salt, limestone and ammonia to make Soda Ash, from which basic material Caustic Soda and other necessary alkalies are derived.*

# RETENE

***(Methyl Isopropyl Phenanthrene)***

**For technical and industrial applications we have available Retene in the following grades:**

**TECHNICAL RETENE**
M.P. 30 to 35°C
Price 5¢ per pound

**TECHNICAL REFINED RETENE**
M.P. 35 to 40°C
Price 8¢ per pound

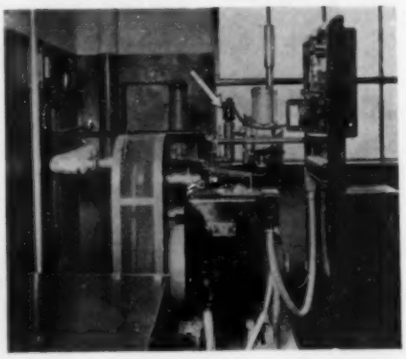
**PURIFIED RETENE**
M.P. 80 to 85°C
Price 26¢ per pound

**PURIFIED REFINED RETENE**
M.P. 90 to 95°C
Price 76¢ per pound

## Southern Pine Chemical Co.

**Division of The Glidden Company**
**JACKSONVILLE, FLORIDA**

# ELECTRIC HEAT aids in testing gasoline for refiners



The engine shown in the above photo typifies standard practice in testing gasoline for octane rating. Before entering the cylinder, the gasoline and air mixture is preheated to 300 deg. F, by a standard Chromalox electric immersion unit inserted in the pipe line with a simple arrangement of pipe fittings.

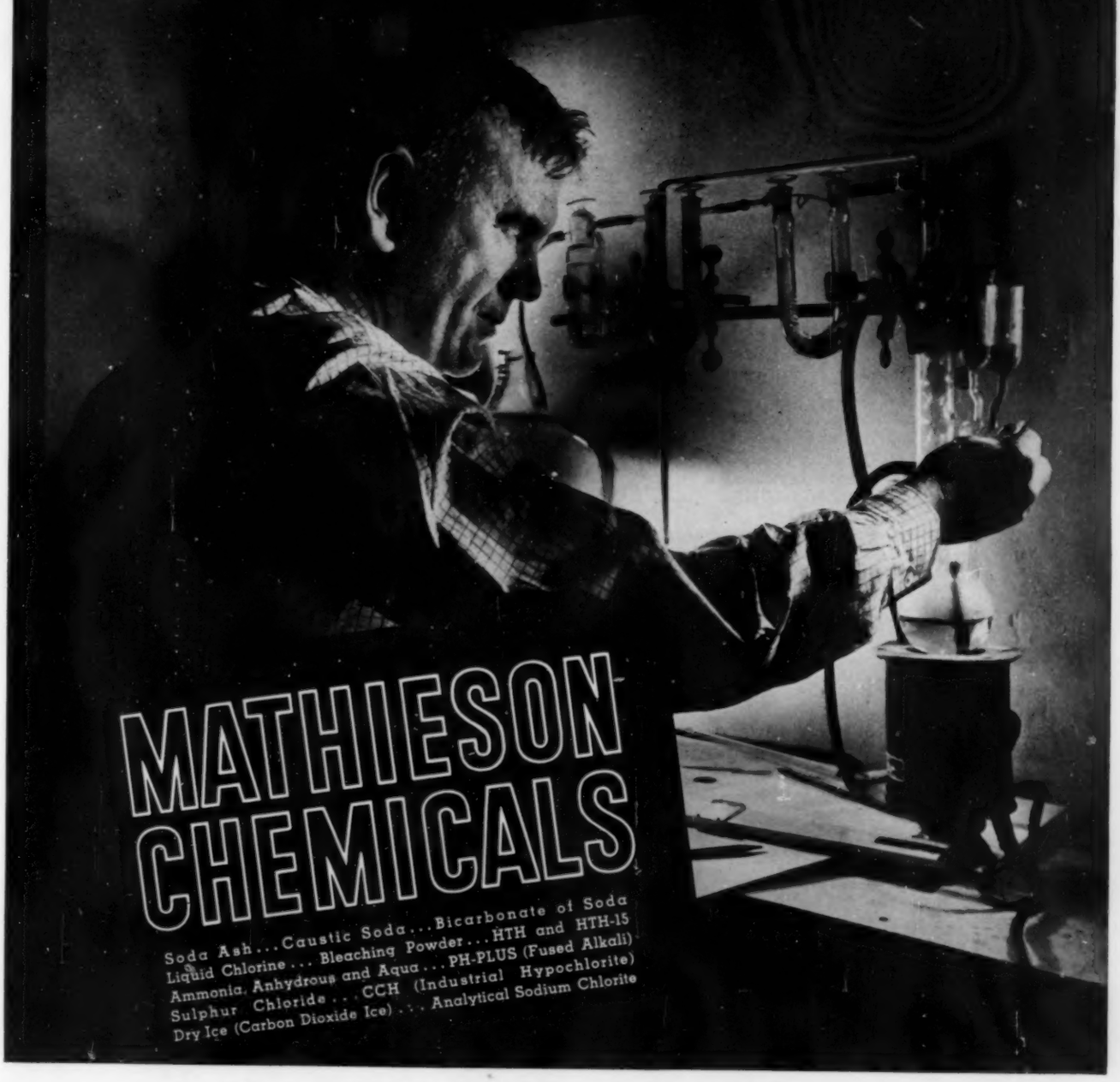
This use of Chromalox electric immersion units to heat circulating oil, water and other liquids or solutions is so efficient and easy to provide that it is employed in hundreds of cases. The Chromalox catalog—on request—describes the wide variety of units available. Wiegand engineers offer willing aid in meeting specific problems. Write us.

**CHROMALOX**
**Electric**
**Immersion Unit**

**EDWIN L. WIEGAND COMPANY**
**7514 Thomas Blvd. Pittsburgh, Pa.**

# A MAN *in the "Lab"*

No cloisters of forgotten heroes are Mathieson's plant laboratories. Manned by solid citizens like capable "Doug" Shannon, Saltville chemist pictured here, these "labs" have played an important part in Mathieson's past record of achievement. And for the future, men like Shannon are an assurance that Mathieson Chemicals will continue to offer as great or greater value than they do today. The Mathieson Alkali Works (Inc.), 60 East 42nd Street, New York, N. Y.



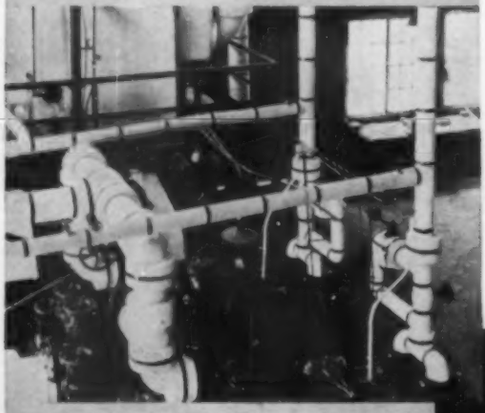
# MATHIESON CHEMICALS

Soda Ash . . . Caustic Soda . . . Bicarbonate of Soda
Liquid Chlorine . . . Bleaching Powder . . . HTH and HTH-15
Ammonia, Anhydrous and Aqua . . . PH-PLUS (Fused Alkali)
Sulphur Chloride . . . CCH (Industrial) Hypochlorite)
Dry Ice (Carbon Dioxide Ice) . . . Analytical Sodium Chlorite

# ARE YOU GETTING YOUR SHARE OF THIS $250,000,000 A YEAR?

**Over a quarter of a billion dollars . . . that is the staggering amount J-M Insulations save American Industry *every year* by reducing fuel and refrigeration costs. And here is how you can be sure your plant receives its full share of this huge saving . . .**

**$11,000 ANNUAL SAVING**—In 1927, the regenerators and flues of this open-hearth furnace in a large Ohio steel foundry were insulated with Johns-Manville materials, applied in accordance with the recommendations of a J-M Insulation Engineer. The net fuel savings *every year* have been more than 400% of the cost of insulation.



**SAVING FUEL, INCREASING EFFICIENCY**—This power plant is typical of hundreds all over the country that are saving thousands of dollars in fuel annually because all their equipment and piping is correctly insulated with the right types and thicknesses of J-M Insulations.

THERE is only one way to assure maximum fuel savings and greatest operating efficiency . . . that is by using the *correct thickness* of the *right insulation* for every service.

And there is one sure way to solve the problem once and for all . . . call in a J-M Insulation Engineer. Let him study your requirements . . . if your present insulations are correct, he'll tell you so. If not, he will prepare a complete recommendation showing the most efficient and economical types and thicknesses of insulation for every piece of equipment in your plant. Furthermore, he'll be glad to prove just how they will give you better heat or refrigeration control and save you money far beyond their cost.

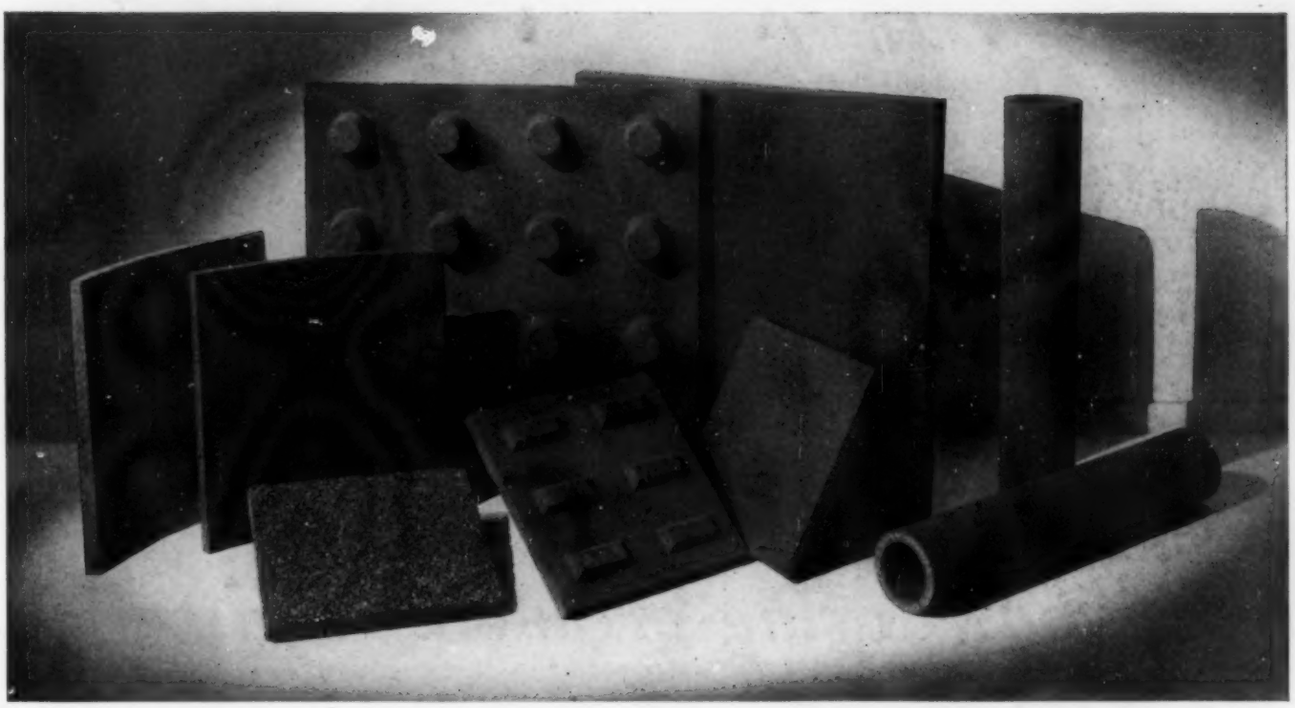
Back of these engineers stands Johns-Manville's 80-year leadership in the development and manufacture of insulations . . . the largest, best equipped Thermal Insulation Laboratory in the world . . . and a complete line of insulating materials in block, brick, cement and pipe-covering form for every temperature, for every service condition.

Why not phone for a J-M Engineer today? His services are free . . . and you'll find one or more in every large city throughout the country. Or, for complete details on J-M Insulating Materials, write for Brochure IN-55A. Address Johns-Manville, 22 East 40th Street, New York, N. Y.

**JM Johns-Manville**

**INDUSTRIAL INSULATIONS**

**for every temperature . . . for every service condition**



# For Commercial and Laboratory Filtering Processes . . .

ELECTRICALLY fused alumina, a chemically stable compound unaffected by most chemical re-agents, is the main constituent in Norton Porous Plates and Tubes. The bonding material also has high chemical resistance for it is essentially a high alumina glass which has been fired at high temperature. As a result, Norton Porous Mediums are especially valuable for many types of industrial filtration and aeration.

Special manufacturing processes assure close control of permeability, pore size, porosity, uniformity and strength. Resistance to heat is excellent due to the highly refractory properties of bonded fused alumina.

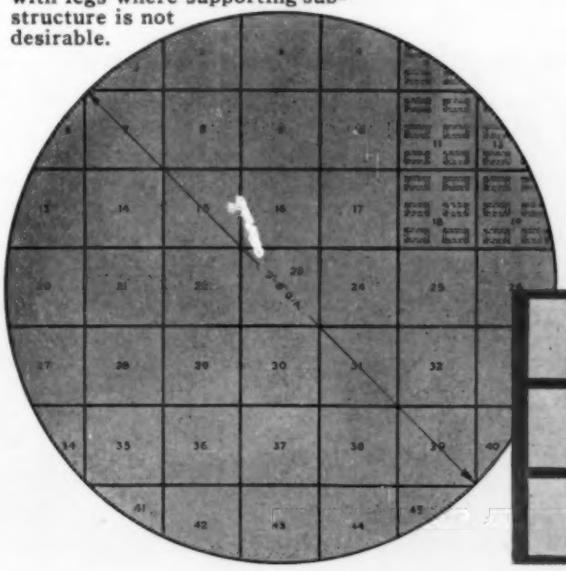
A 16-page booklet, with charts and tables, gives full information on the physical and chemical properties of Norton Porous Mediums and illustrates with dimension drawings the rectangular and curved plates, discs, tubes and special shapes that are available. Send for a copy.

NORTON COMPANY, WORCESTER, MASS.

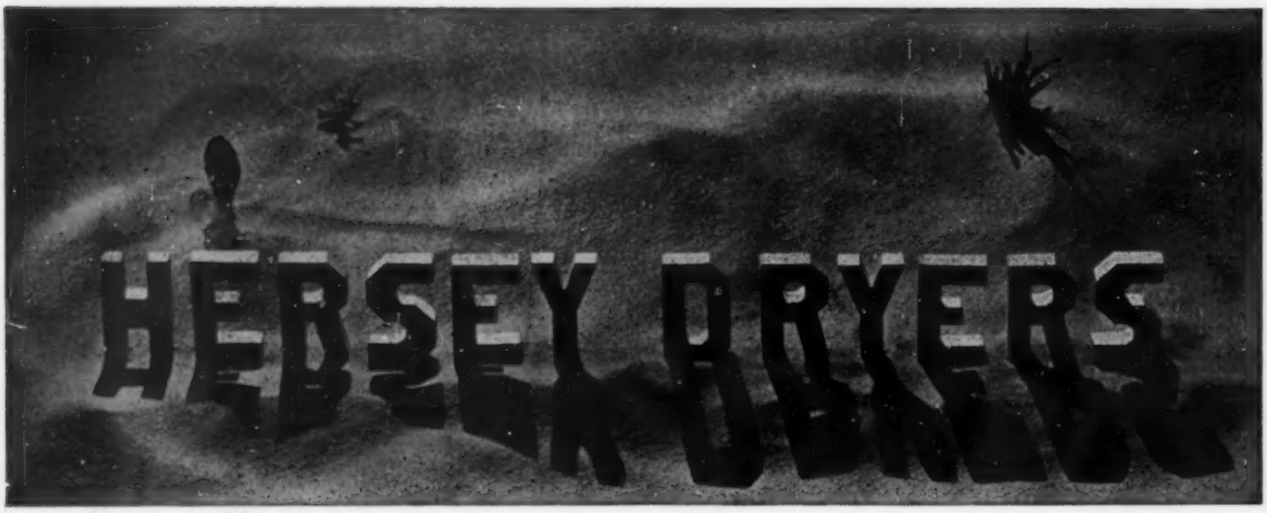
New York Chicago Cleveland

R-804

CIRCULAR TANK BOTTOM using special Norton Plates with legs where supporting substructure is not desirable.



**NORTON POROUS MEDIUMS**




# *Does your drying problem require*

**Unusually low cost of operation and maintenance?**

**Accurate control of all temperatures?**

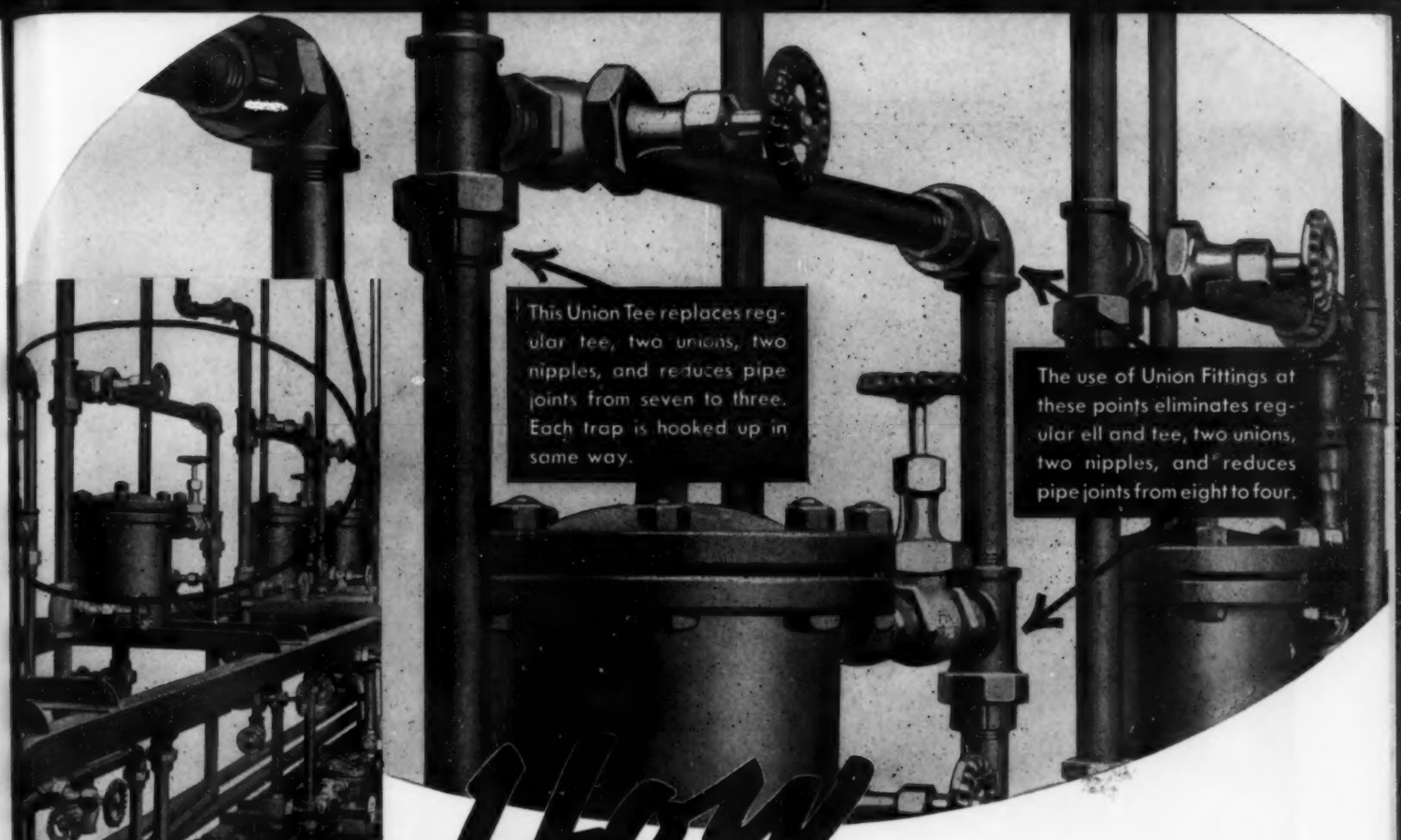
**Equipment built of special metals?**

**Hersey Engineers have aided many large industries in successfully solving these problems. We are equipped to make laboratory or field tests on any phase of continuous rotary drying.**

## HERSEY MANUFACTURING COMPANY

CORNER E AND WEST SECOND STREETS

SOUTH BOSTON, MASS.


This Union Tee replaces regular tee, two unions, two nipples, and reduces pipe joints from seven to three. Each trap is hooked up in same way.
The use of Union Fittings at these points eliminates regular ell and tee, two unions, two nipples, and reduces pipe joints from eight to four.

# How CRANE UNION FITTINGS SAVE MATERIAL, TIME AND LABOR

A comparison of piping materials and pipe joints required to hook up this bank of steam traps—

| | —with Union Fittings | | —with Regular Fittings | |
|---|---|---|---|---|
| | Quan. | Pipe Jts. | Quan. | Pipe Jts. |
| Ells | 1 | 2 | 13 | 26 |
| Union Ells | 12 | 24 | | |
| Tees | | | 11 | 33 |
| Union Tees | 10 | 30 | | |
| Unions | | | 26 | 52 |
| Nipples | 16 | 32 | 43 | 86 |
| TOTALS | 39 | 88 | 93 | 197 |

**99 9,996,551/10,000,000 %**

*of Crane fittings are found fit. Details in folder sent upon request.*

The use of union fittings in piping systems is often overlooked. They are valuable even in simple hookups, but in more elaborate layouts, their advantages are emphasized. Because a single union fitting ordinarily serves the same purpose as a tee or elbow, union and nipple, installation costs are minimized—in material, time and labor. Union fittings reduce the number of threaded joints—giving greater safety. Pipe lines gain a workmanlike makeup that adds to plant appearance.

Depend on Crane-Quality union fittings to help keep your liquid, air, and vapor lines at peak efficiency always. The amazing standard of perfection that Crane has attained in the manufacture of millions upon millions of fittings of every type yearly, is strong assurance of their unfailing, trustworthy performance. You'll find that Crane-Equipment throughout your plant brings greatest piping satisfaction, because—in fittings as in valves—

***IT'S WHAT'S INSIDE THAT COUNTS!***

# CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVENUE, CHICAGO, ILLINOIS

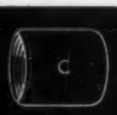
**NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS**

## CRANE SCREWED FITTINGS FOR CHEMICAL PROCESSING PLANTS

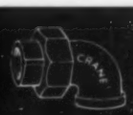
Crane's line of fittings includes not merely the few hundred types and sizes in most common use, but a total of more than 10,000 separate and distinct items in cast and malleable iron.

**ELBOWS**—90°, 67½°, 60°, 45°, 30°, 22½°, 11¼°, and 5⅝°, Street, Long Sweep, Side Outlet, Drop, Hub Vent

**TEES**—Service, Four-Way, Drop Tees, Long Sweep, Double Sweep, Wash Tray



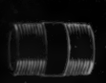
**COUPLINGS**—Right Hand, Right and Left, Half (Also Wrought Iron), Reducers, Increasers



**UNION FITTINGS**—Male and Female, 90° and 45° Elbows, Tees with Union on Run or Outlet

**BUSHINGS**—Outside and Inside Hexagon, Face, Eccentric, Double Tapped

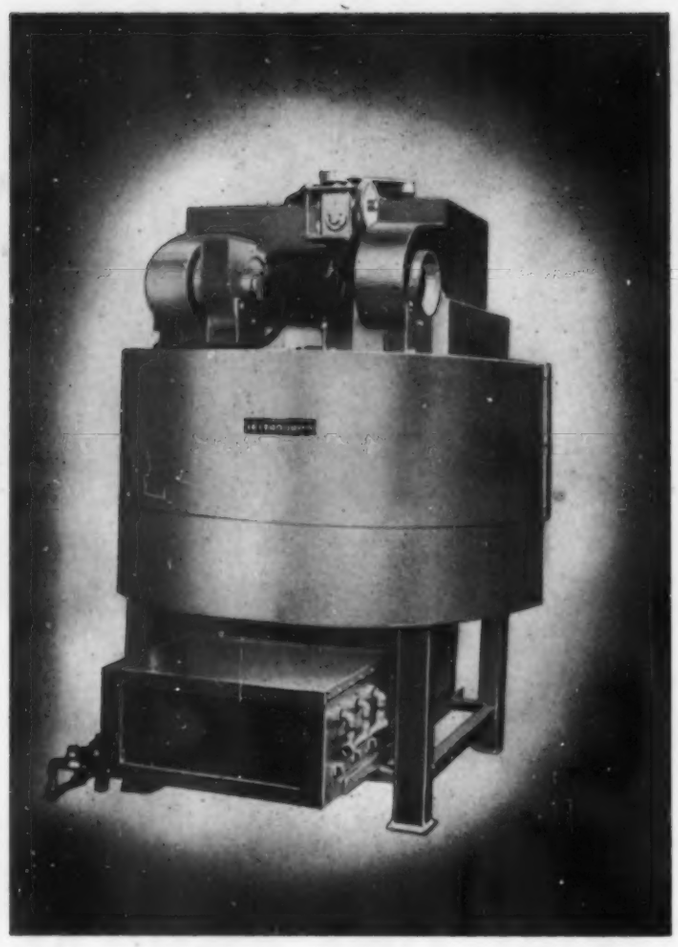
**PLUGS**—Square Head, Solid, Countersunk, Bar, Barrel

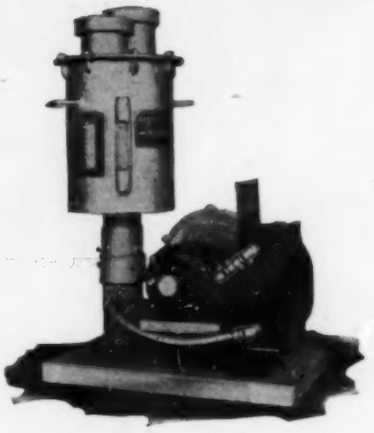


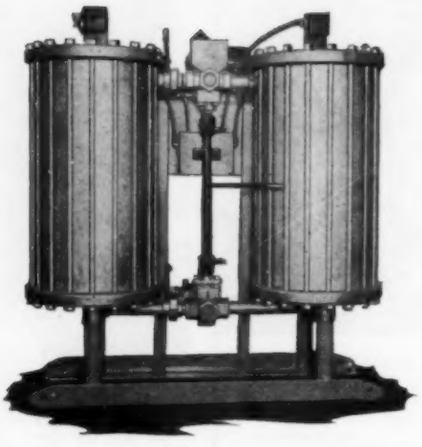
**NIPPLES**—Close, Short, Long, Tank

**UNIONS**—Ground Joint, Gasket Type, Female, Male and Female, Air-Pump

**A CRANE FITTING FOR EVERY PURPOSE**—The screwed fittings shown above are only a few of the scores of different types and modifications. The complete Crane line includes banded and plain patterns, black or galvanized, in a wide range of straight and reducing sizes, in four pressure classes in malleable iron and five in cast iron.







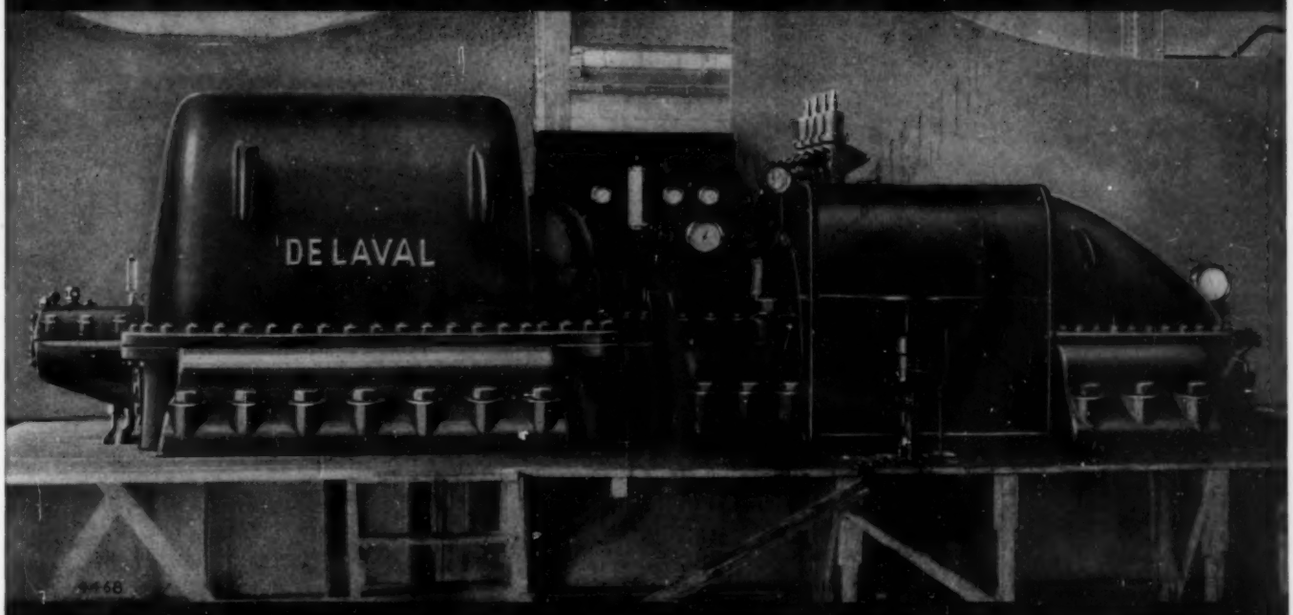
# THERE ARE MANY LECTRODRYER USES!

LECTRODRYER equipment has many interesting uses. Many chemical and pharmaceutical manufacturers now use the LECTRODRYER for maintaining lower than normal relative humidities in their process, storage or packing rooms. LECTRODRYERS are also used for drying compressed air thoroughly and dependably. The LECTRODRYER Breather, illustrated in the upper right hand corner above prevents entrance of atmospheric moisture into storage tanks where white oils or moisture affected chemicals are stored. We will be glad to furnish information.

## PITTSBURGH LECTRODRYER CORPORATION

**32ND ST. & PUTNEY WAY PITTSBURGH, PA.**

# REPEAT ORDER FOR




# BLAST FURNACE BLOWER

A Mid-Western steel company, after operating a DE LAVAL STEAM TURBINE DRIVEN BLAST FURNACE BLOWER for about a year, is now installing a second De Laval unit of 85,000 cu. ft. per min. of free air capacity against 30 lb. pressure.

The photograph shows the unit on shop test at the De Laval Works. The turbine receives steam at 400 lb. gage and 700° F. and exhausts to a 28 in. vacuum. The normal full load speed is 2800 r.p.m., but constant volume of discharge is maintained automatically by an improved governor control.

*By utilizing recent developments in high pressure, high temperature steam and in turbine design, the cost of power for compressing air and gases can be greatly reduced. Our engineers will gladly supply data and estimates upon learning of your requirements.*

*Ask for Catalog F.*

3307

DE LAVAL *Steam Turbine Co.*
TRENTON, N.J.

MANUFACTURERS OF STEAM TURBINES, PUMPS—CENTRIFUGAL, PROPELLER, ROTARY DISPLACEMENT, CENTRIFUGAL BLOWERS AND COMPRESSORS, WORM GEARS, HELICAL GEARS, HYDRAULIC TURBINES AND FLEXIBLE COUPLINGS • • • SOLE LICENSEE OF THE BAUER-WACH EXHAUST TURBINE SYSTEM

# Prevent Heat Waste
# Assure Uniform Warmth—Save Money
## *with Sturtevant Rexvane Heaters*

*Stock and shipping room of large Eastern Manufacturer, heated by eight Sturtevant Rexvane Heaters. Total B. T. U.—6,800,000, with 60° entering air; 10 lbs. steam pressure. Total C. F. M.—95,680.*

### THIS TOUGH HEATING JOB SHOWS HOW IT'S DONE

THIS LARGE AREA is the shipping and stock room of a well-known Eastern Manufacturer. It is 460 ft. long and 60 ft. wide—with a ceiling 31½ ft. high!

Eight Sturtevant Rexvane Heaters take care of the entire heating job. Yet, despite the size of the area and great height of the ceiling, the temperature is kept uniformly warm over the entire space at floor line.

No valuable floor space taken up—all units hung overhead, at the walls.

If you have a heating problem, let us show you, too, how you can prevent heat waste, assure uniform warmth and save money with Sturtevant Rexvane Heaters. Our nearest representative will gladly call or mail Catalog 395-3.

B. F. STURTEVANT COMPANY Hyde Park, BOSTON, MASS.
*Sales Offices* in 40 Cities B. F. Sturtevant Co. of Canada, Ltd.—Galt, Toronto, Montreal

### *Rexvane Heater Advantages*

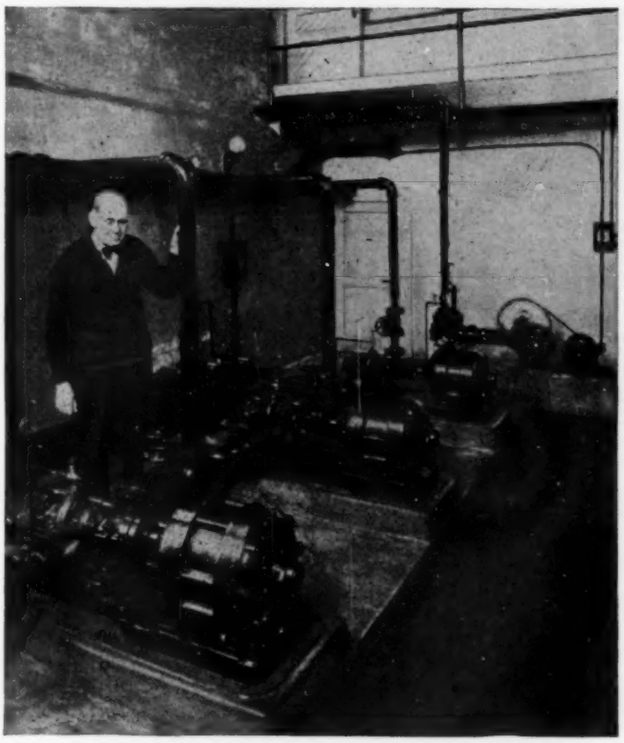
1. **Guaranteed for 200 lbs. Pressure**
   And suitable for all steam pressures up to 200 pounds.
2. **Low Final Temperatures**
   Assure comfort for people near heaters.
3. **Guaranteed Capacities**
   In accordance with A. S. H. V. E. requirements.
4. **Wide Range of Sizes**
   Up to 1,421,000 B.T.U. (Standard rating).
5. **Flexibility of Application**
   All sizes available for either floor, wall or ceiling installation — belt or direct drive.
6. **High Efficiency**
   Large air volume handled with comparative quietness—at high efficiency—and extremely low horse-power.
7. **Time-Saving Installation**
   Sectional construction permits reversal of fan, heating, and center units to meet unexpected piping or other conditions on job.
8. **Thermadjust Control**
   Optional; either automatic or manual operation.
9. **Three-Bearing Construction**
   Assures long shaft life. Center bearing easily re-aligned on job by any mechanic.

**Sturtevant**
REG. U. S. PAT. OFF.
*Puts Air to Work*

**Fans, Blowers, Air Washers, Air Conditioning, Heating, Vacuum Cleaning, Drying, Mechanical Draft Equipment**

# CITY SAVES $38,000!

## Read How City of Hastings, Michigan, Saved Over $6300 a Year in Pumping Costs and Cut Water Rate 15% . . . by Replacing Old Pumps with Allis-Chalmers!



THE WATER DEPARTMENT AT HASTINGS, MICHIGAN. City Engineer Bert Sparks inspects the pumps that have saved the City of Hastings as much as $6372 in a single year! They are an Allis-Chalmers 2½" x 2" Type SJH, rated 250 gpm at 150 ft. head, and two Allis-Chalmers 3" x 2½" Type SJH pumps, each rated 350 gpm at 150 ft. head.

Water rate reduced 15%! Reserve fund of $11,000 built up by a department that previously showed a deficit. $38,000 saved in pumping costs!

That's what actually happened in the City of Hastings, Michigan, when City Engineer Bert Sparks replaced steam driven reciprocating pumps with three Allis-Chalmers motor-driven centrifugal pumps!

It's not hard to understand why! The former fuel cost for steam-driven pumps was 6c per 1000 gallons pumped. But the cost for the Allis-Chalmers motor-driven pumps is only 1¾c per 1000 gallons. That means an actual average saving of $6372 per year to the City of Hastings, in pumping costs alone! $38,000 since the pumps were installed!

### Allis-Chalmers Engineering Cuts Costs!

No wonder that when a fourth pump was purchased in the fall of 1937, the City of Hastings specified Allis-Chalmers! For the engineering that has created Allis-Chalmers equipment means lower costs . . . actual savings in dollars and cents. And like savings result from Allis-Chalmers assumption of undivided responsibility for both pump and drive!

What Allis-Chalmers Centrifugal Pumps have accomplished for the City of Hastings, they can do for your city or for your factory. The Hastings installation is typical of the way Allis-Chalmers has solved municipal and industrial pumping problems throughout the country. There's an Allis-Chalmers representative near you. Let him show you how Allis-Chalmers pumps can actually pay for themselves . . . how many dollars they can save!

CENTRIFUGAL PUMP DIVISION

ALLIS-CHALMERS

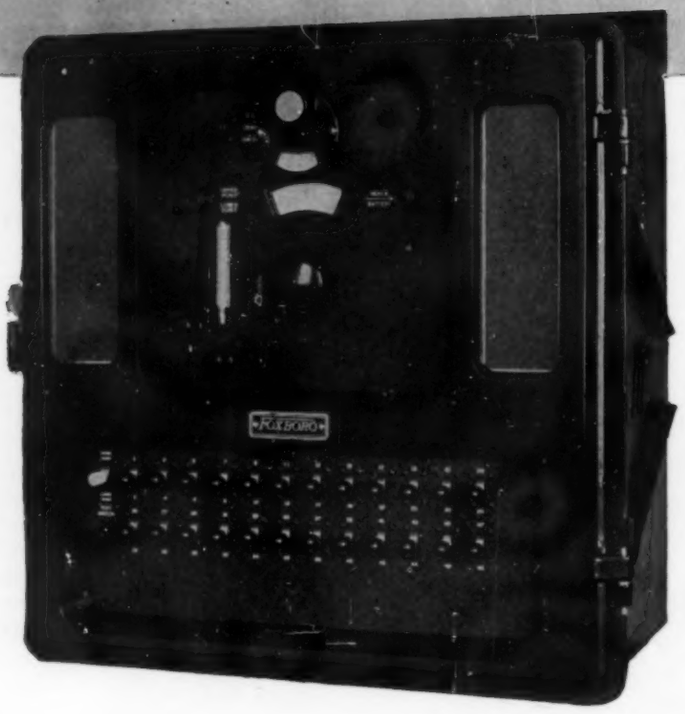
MILWAUKEE-WISCONSIN

AC

SINGLE-STAGE DOUBLE-SUCTION PUMPS • CLOSE-COUPLED SINGLE-STAGE SSUnit PUMPS • MULTI-STAGE PUMPS • PAPER STOCK PUMPS • MIXED FLOW AND AXIAL FLOW PUMPS • AND SPECIAL DESIGNS FOR UNUSUAL APPLICATIONS

# CENTRALIZE

## YOUR SCATTERED TEMPERATURE INFORMATION WITH THE...




## *New* FOXBORO Key-Switch Cabinet Indicating Pyrometer

Where centralized information as to temperatures at numerous and scattered points is necessary or desirable, this indicator is ideal. The attractive, orderly simplicity of appearance is a reflection of the sound engineering, the convenience and accuracy of operation which characterize this new Foxboro instrument.

Seventeen inches of clear, open, easy-to-read scale operated by a vernier dial knob simplifies ease and accuracy of reading. Accuracy of the indicator is guaranteed to within ¼ of 1% of its full scale value. Switches and rheostat are totally enclosed and dust-tight. No push button or plug and socket connections are used. Accurate cold junction compensation is assured. All connections are available from the front of the panel, greatly simplifying installation.

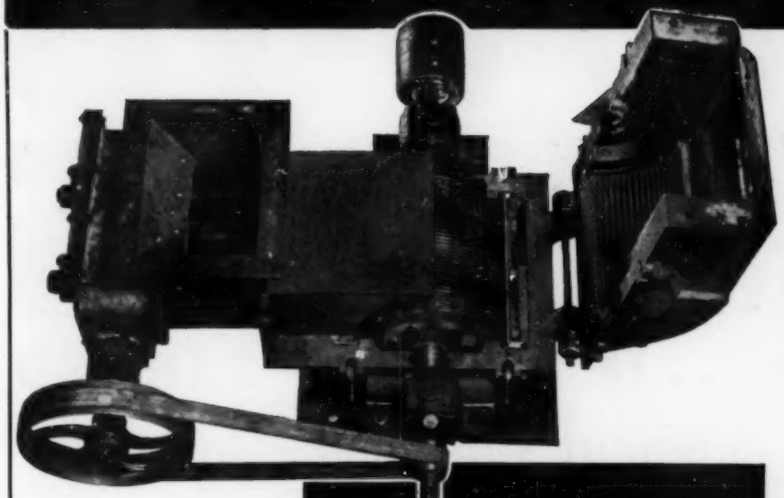
There are dozens of advantages, each of practical value in guaranteeing accurate . . . dependable . . . and convenient operation. Write for complete information.

**THE FOXBORO COMPANY**
**16 Neponset Ave., Foxboro, Mass., U.S.A.**
**Branch Offices in 25 Principal Cities**

**FOXBORO**
REG. U. S. PAT. OFF.

**KEY-SWITCH CABINET INDICATING PYROMETER**

# Dustless Fine Grinding



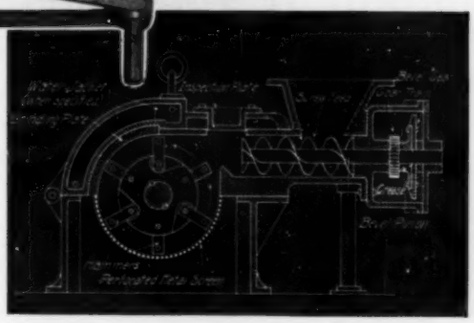
*(With Small Investment)*

## 100 to 325 Mesh

*with the*

## "Helix-Seal" Mill

- No Elaborate Air Equipment
- Easy to Install
- Cheap to Operate
- Little Floor Space
- Grinds Wet or Sticky Material



(above) A Helix-Seal Mill viewed from above. Note how the cover can be raised providing access to the interior for repairs and adjustments. (right) Sectional view of the Helix-Seal Mill.

Attention is directed to the long grinding plate against which the material is ground before it reaches the sizing screen. Most sizes are equipped so this plate is adjustable toward the hammers to compensate for wear.

One of the outstanding features of the Williams Helix-Seal Mill is its ability to grind extremely fine without the aid of outside separation, such as air separators, screens or reels. This is largely due to the long grinding surface in the mill, the adjustable grinding plate and the high speed of the hammers.

The screw feed which feeds the material into the grinding chamber acts both as a feeder and as a seal, sealing the intake opening against the inrush of air, and as no air is sucked into the machine there is no resulting dust carrying draft expelled from the discharge. Repeat orders from America's largest chemical plants is definite proof of the Helix-Seal's ability to grind fine.

"9 Sizes—Write today for Bulletin 557"

**Williams Testing Laboratory is at your service. Send us your material and we will submit our report to you.**

The Williams BX Size Helix-Seal Mill

**The Williams Patent Crusher & Pulverizer Co.**

**2706 N. Ninth St. — St. Louis, Mo.**

SALES AGENCIES IN ALL PRINCIPAL CITIES INCLUDING

| Chicago | New York | San Francisco |
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| 37 W. Van Buren | 15 Park Row | 326 Rialto Bldg. |

OLDEST AND LARGEST BUILDERS OF HAMMERMILLS IN THE WORLD

**Williams**

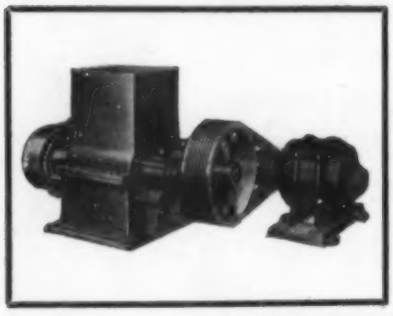
PATENT CRUSHERS GRINDERS SHREDDERS

MODERN PROCESSING EQUIPMENT

# PAYS YOU DIVIDENDS

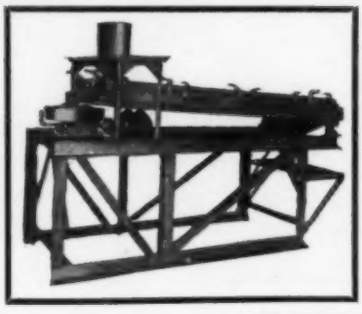
IN MONEY SAVED . . . IN PROFITS EARNED

*Check ✓ the equipment you need—Now*



**CRUSHERS**

Our Saw Tooth Crusher is a sturdy, efficient machine used extensively for crushing or reducing bulky materials such as pressed cake of all kinds, lumpy chemicals, charcoal, glue, cork, talc, phosphate rock, and various scrap materials. Fully illustrated and described in Bulletin No. 36-D.

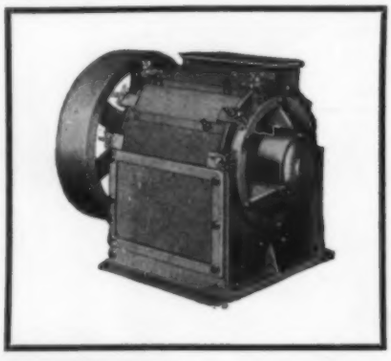


**SIFTERS**

Robinson Gyro-Sifters, Swing Sifters, and other Screening Machines are the result of nearly forty years of experience in building Sifting Machines for all sorts of materials. Our Sifters give maximum screening capacity on minimum floor space. Fitted throughout with ball bearings, consequently run with a minimum amount of power. They produce various desired grades of products of uniform fineness.

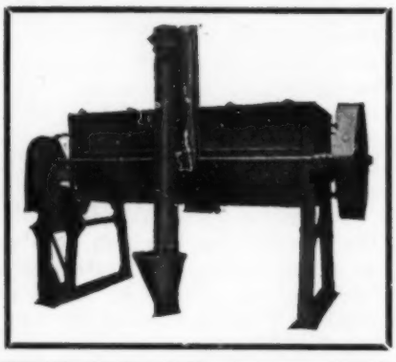
**CUTTERS**

Our Knife Cutter is of heavy durable construction and is especially designed to permit immediate inspection and adjustment of knives. Knives are extra heavy with liberal inserts of hard high carbon steel. A screen retains the material within the chamber until cut fine enough to pass through the selected perforations.



**MIXERS**

We manufacture a complete line of Mixers for both dry and liquid products. Our line includes the famous moderately priced GARDINER Mixers and a long line of Custom Built UNIQUE Mixers of various sizes and types. Our Mixers are made with or without Sifter attachment, with plain or steam jacketed bodies, and are frequently made of Stainless Steel, Monel Metal, or other non-corrosive materials. Write for Catalog No. 32-E.



**GRINDERS and PULVERIZERS**

We manufacture a complete series of machines for grinding and pulverizing various chemicals and other materials. Our machines are made in various sizes and types to suit different products and capacity requirements, and are frequently made of non-corrosive metal, such as Monel, Stainless Steel, etc. Write for Bulletin No. 36-D.

**OTHER ROBINSON PRODUCTS**

In addition to the above, we manufacture labor saving devices for receiving and storing products, Sack Cleaners, Bag Pilers, Elevators, Conveyors, Barrel Compactors, Power Transmission Machinery, Sheet Metal Tanks, Bins, Hoppers, etc. *Literature on any or all items of Processing Equipment is available on request. Write, phone, or wire us today.*

ROBINSON PRODUCTS INCREASE PRODUCTION PROFITS

**ROBINSON MFG., CO.** 72 PAINTER ST. MUNCY, PA.

# *20,000 Customers*
# BUILT THIS TOOL FOR YOU

**The money-saving and time-saving experience of over 20,000 customers has been important in the development of the Acme Steelstrap system. The new No. 2 Steelstrapper combines stretching, sealing and cutting operations with an automatic seal feed. It is the latest addition to a complete line of tools designed for the sole purpose of helping shippers to economically apply Steelstrap and make shipments "Bound to Get There." One or more of these Steelstrap tools will exactly meet your requirements and provide maximum economy.**

**Acme Steelstrap is sold *only* by Acme sales engineers. They are competent and fully qualified to make practical suggestions for safer, more economical packings of any type of product shipped in any kind of wrappings and containers.**

**Doc Steelstrap has had over 55 years of experience in helping manufacturers reduce their packing and shipping costs. He will be glad to tell you the amount which *you* can save by using Acme Steelstrap. Write for complete data, today. There is no obligation.**

**ACME STEEL COMPANY**
2851 ARCHER AVENUE, CHICAGO, ILLINOIS
BRANCHES IN PRINCIPAL CITIES

WE MEAN

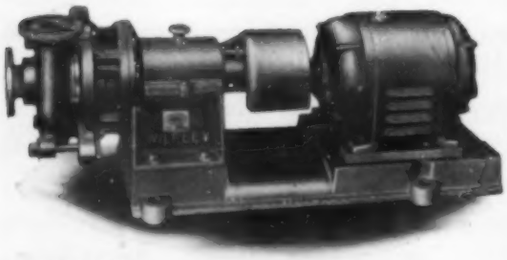
# *No* Stuffing Box
## *– It's Eliminated!*

MODEL AB
DRIP-PROOF MOTOR

**This Acid Pump Will Solve Your Hardest Problem**

With the stuffing box completely eliminated, there is no chance for stuffing box contamination, or any other stuffing box trouble. This WILFLEY acid pump solves the HARDEST acid-pumping problem —gives you long, uninterrupted periods of *dependable* performance *without attention.*

Wherever WILFLEY acid pumps have been installed and TRIED, they have invariably won orders for *additional* pumps. Many firms have ordered from one to five more pumps; one ordered twenty; many are gradually changing to Wilfleys exclusively. Made in 10- to 1,000-g.p.m. capacities; 15- to 110-ft. heads—and larger. High discharge heads handled without trouble. Effective sealing blades—no worry about leakage. No matter how difficult YOUR acid pumping job it will pay you to install WILFLEY pumps. Write for complete details.



MODEL AC
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DIRECT DRIVE • BELT DRIVE • UNITARY • ACID PUMPS

# PLATINUM

## AS A TOOL OF PRODUCTION

THE indispensability of platinum in the chemical laboratory scarcely needs comment, but reference to it is justified in order to point out that the same qualities which enable the chemist to make his accurate analyses and to produce new substances, will perform equally useful services in actual production. The inertness of platinum is one of its chief characteristics, fortunately coupled with an extraordinary versatility and adaptability to the most diverse applications.

Although many manufacturing processes now employ platinum as one of the actual tools of production, notably in the manufacture of nitric and sulphuric acids, for the spinnerettes used in rayon manufacture and for the protection of refractory surfaces in glass making, yet the potentialities of the metal have hardly been realized by many industries with problems that platinum probably could solve.

Platinum-Clad, which is a sheet of any desired metal with one or both surfaces protected by platinum of any thickness, can be shaped and welded into any form. It is valuable for a great variety of processes.

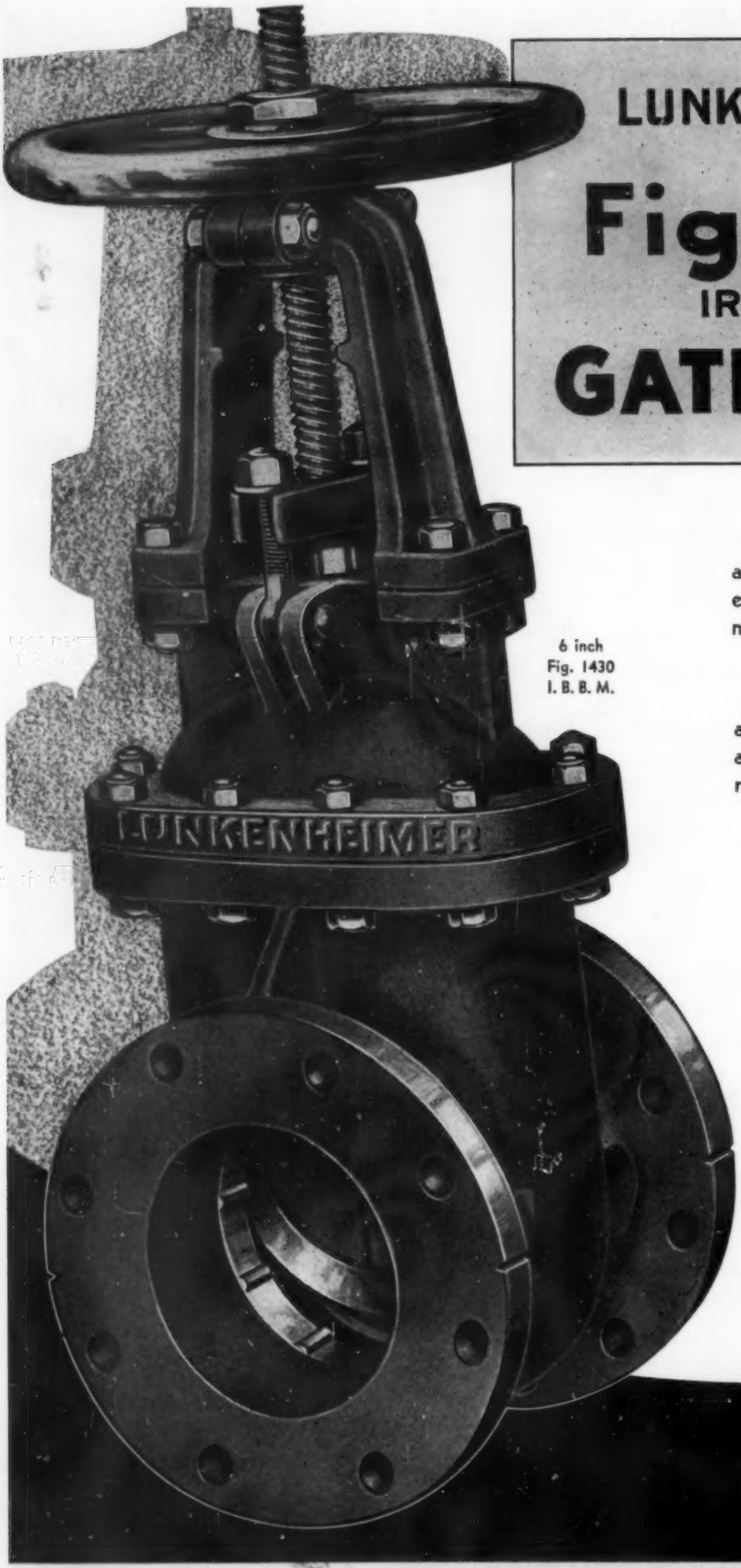
There is the economical side, of course, and it is in platinum's favor. Platinum is a capital investment. It can always be converted into cash. So, when the installation of platinum or platinum-clad equipment is up for consideration, remember that this investment is made but once—upon the first installation. Always, when replacements or changes occur, the platinum, in the old equipment, goes to pay far the greater part of the cost of the new.

So often we have been able to help solve the difficulties of other manufacturers with platinum that it may well be that we can do the same for you. It will cost you nothing to have one of our scientific research staff consult and work with you. Why not do it now?

**BAKER & CO., INC.**

113 Astor Street, Newark, N. J.

NEW YORK SAN FRANCISCO CHICAGO




6 inch
Fig. 1430
I. B. B. M.

# LUNKENHEIMER
# Fig. 1430
## IRON BODY
# GATE VALVE

Recognized for their dependability and long service life, they effect substantial reductions in maintenance expense.

Available in bronze mounted and all-iron; inside and outside screw and quick operating; for all service requirements.

If you have no copy of List Price Schedule R1 giving new list prices of Lunkenheimer products, ask your local Lunkenheimer distributor or write The Lunkenheimer Co., Cincinnati, Ohio.

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"QUALITY"
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## INTERMEDIATE ALLOY STEEL SEAMLESS TUBES
## For Economical Service In The Chemical Industries

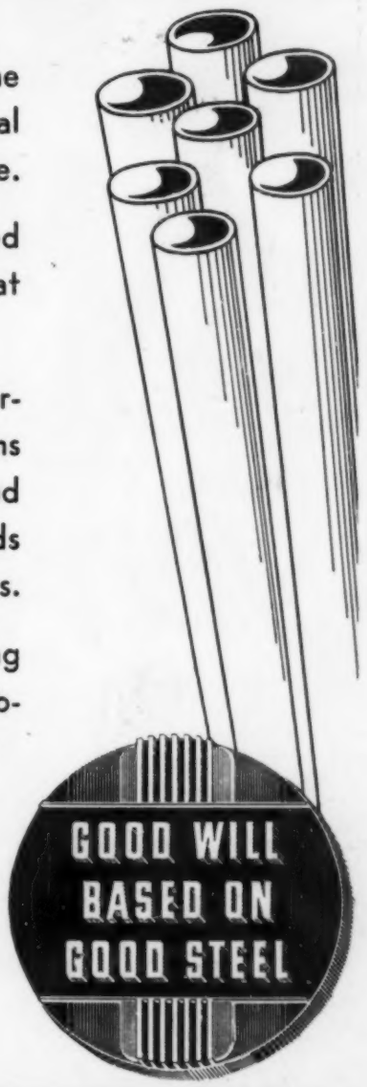
The use of more expensive tubes than are necessary for the handling of any particular kind of liquid is just as uneconomical as the use of low cost tubes that are inadequate for the purpose.

Our experience in the various process industries has proved that intermediate alloy steels offer a ratio of life to cost that makes their use a real economy.

We have developed a number of different types of intermediate alloys to meet various conditions and combinations of conditions such as corrosion, oxidation, temperature and pressure. The careful selection of these steels for different kinds of tube service has resulted in substantial savings for their users.

If your tubes are costing too much—if you are not getting the life you think you should be getting, it will pay you to submit your problems to our tube specialists with a view to the adoption of TIMKEN Intermediate Alloy Tubes especially selected for your requirements.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO
STEEL AND TUBE DIVISION




Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; TIMKEN Rock Bits; and TIMKEN Fuel Injection Equipment.

**TIMKEN**
**SEAMLESS STEEL TUBES**

# GARLOCK 875
## GAS COMPRESSOR METAL PACKING

GARLOCK 875 Metal Packing is made of improved, non-abrasive iron. Gives long dependable service on high or low stage gas compressors.

# IMPROVED!
## FOR LONG SERVICE

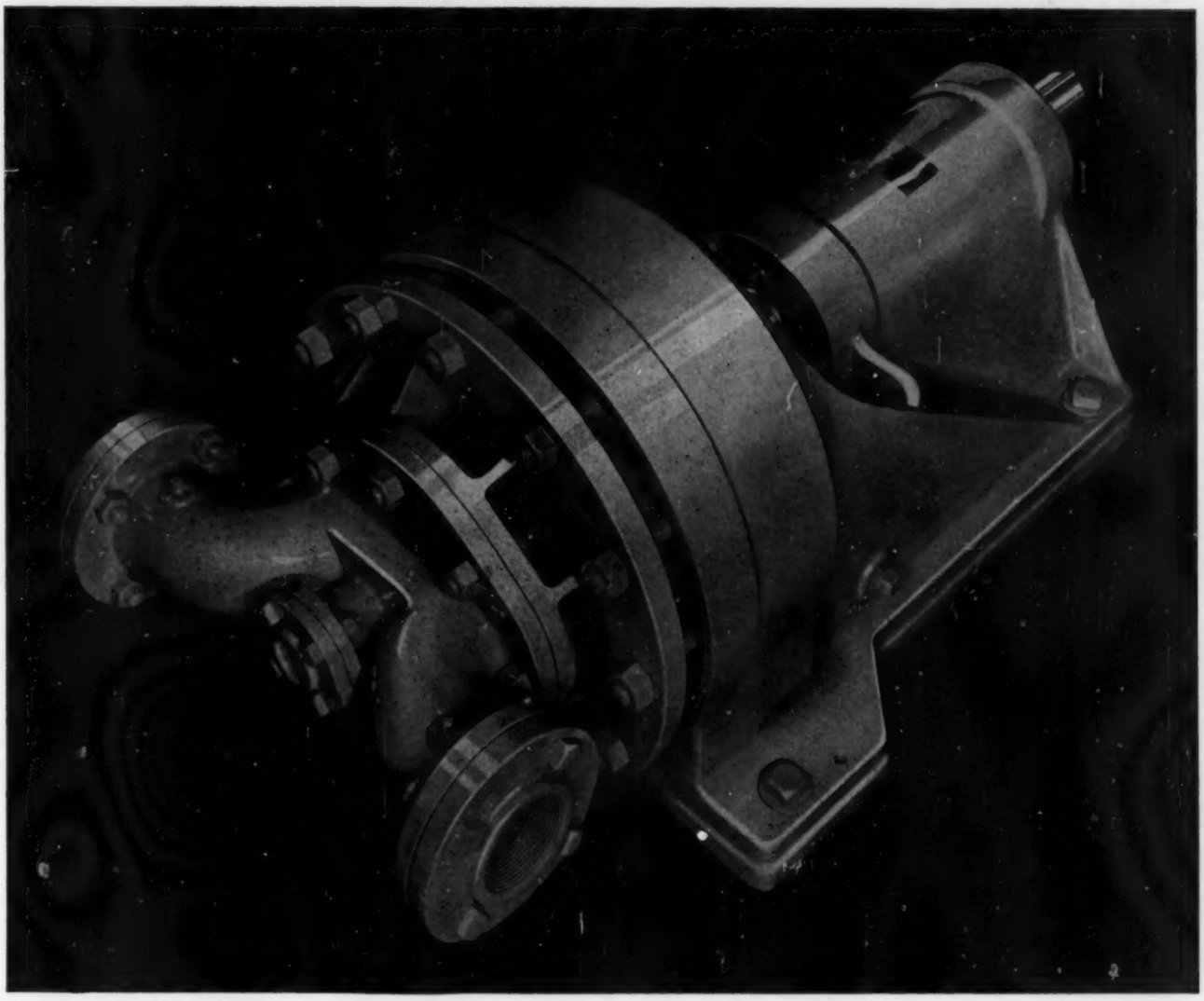
NEW metals and new processes are enabling progressive manufacturers to build greater wear-resistance and longer life into their products. So it is with GARLOCK Metal Packings. Our improved iron was developed after exhaustive, accelerated-wear tests in one of America's leading universities. In actual service it has conclusively demonstrated its superiority.

Frequent periodic tests guarantee the uniformity of this quality controlled iron. These new, improved GARLOCK Metal Packings will give remarkably long economical service.

THE GARLOCK PACKING COMPANY, Palmyra, New York
In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

# GARLOCK

# Handle Corrosive Gases, Vacuum or Pressure with the New Corrosion Resisting Nash . . .



## NEW CORROSION RESISTING DESIGN, BUT STILL ONLY ONE MOVING PART

NASH ENGINEERING COMPANY
SOUTH NORWALK, CONNECTICUT, U.S.A.
BULLETIN 285
NEW NASH COMPRESSOR AND VACUUM PUMP DESIGNED ESPECIALLY FOR CORROSIVE GASES

WRITE FOR SPECIAL BULLETIN NO. 285 . . IT IS FREE TO YOU ON REQUEST

The corrosion resisting Nash is of entirely new design permitting the use of many corrosion resisting materials . . . such as Hastelloy, Illium, High Silicon Iron, Monel, Nickel, etc. This permits the handling of corrosive gases directly in the pump structure.

Nash simplicity has been retained, and the new pump has but one moving part. There is but one stuffing box, of unusual depth, and easily accessible. The heavy ball bearings are located entirely away from the pump structure, and are completely protected from possible leakage from the stuffing box.

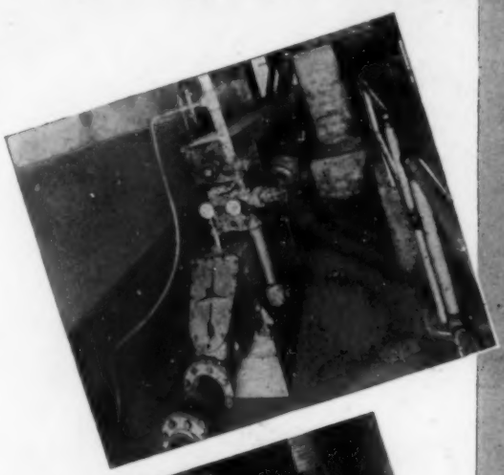
Like all Nash Compressors, this pump delivers only clean gas, free from dust, heat or oil. The single moving part rotates without metallic contact, and no lubrication is required. Capable of pressures up to 75 lbs., and vacuums of 27" of mercury, this new pump is worth your careful consideration.

## NASH ENGINEERING COMPANY
## SOUTH NORWALK · CONNECTICUT · U. S. A.

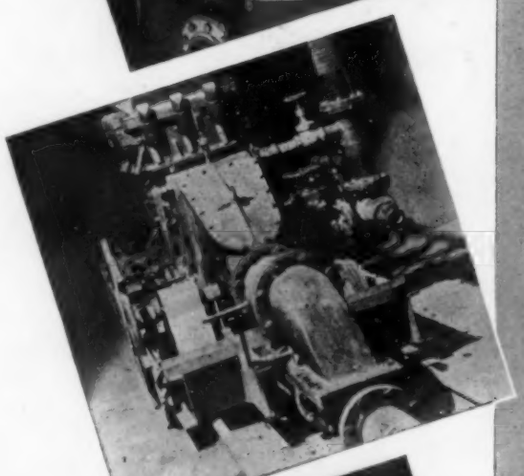
# *There's a* FULLER-KINYON PUMP *for every application*

Fuller-Kinyon Systems are available in many types and for transporting varied dry pulverized materials. They offer to manufacturers and users of such materials many novel functions and methods in addition to direct economies obtainable.

Stationary Fuller-Kinyon Pump: A full range of capacities to convey from any source of supply from which material can descend by gravity to the hopper of the pump. For example, conveying from grinding mill discharge spouts or collecting screws serving a plurality of mills; to storage silos or bins; from storage silos to packer bins; and directly to cars, barges, and ships for bulk loading, and recirculation for mixing and blending of materials.



Portable Fuller-Kinyon Pump: Has many uses and is commonly employed for withdrawing cement from silos to expedite shipment of standard, tested, and special cements, either in bags or bulk. The pump, traveling on tracks, may be moved from one point of discharge to another and placed in operation in a few minutes, thereby avoiding any delays in packing different cements. It offers unusual advantages in speed in transferring cement from silos or from several in a group to one or more packer bins.



Fuller-Kinyon Automatic Remote-Control Unloader: Used for unloading and conveying Portland cement and other pulverized materials, and differs considerably from those previously manufactured by the Company. It offers a wider field of utility and greater handling capacity. SAFETY—Safe for use in cement mill stockhouses. Remote control keeps the operator out of the bin...out of danger from slides... out of the dust.

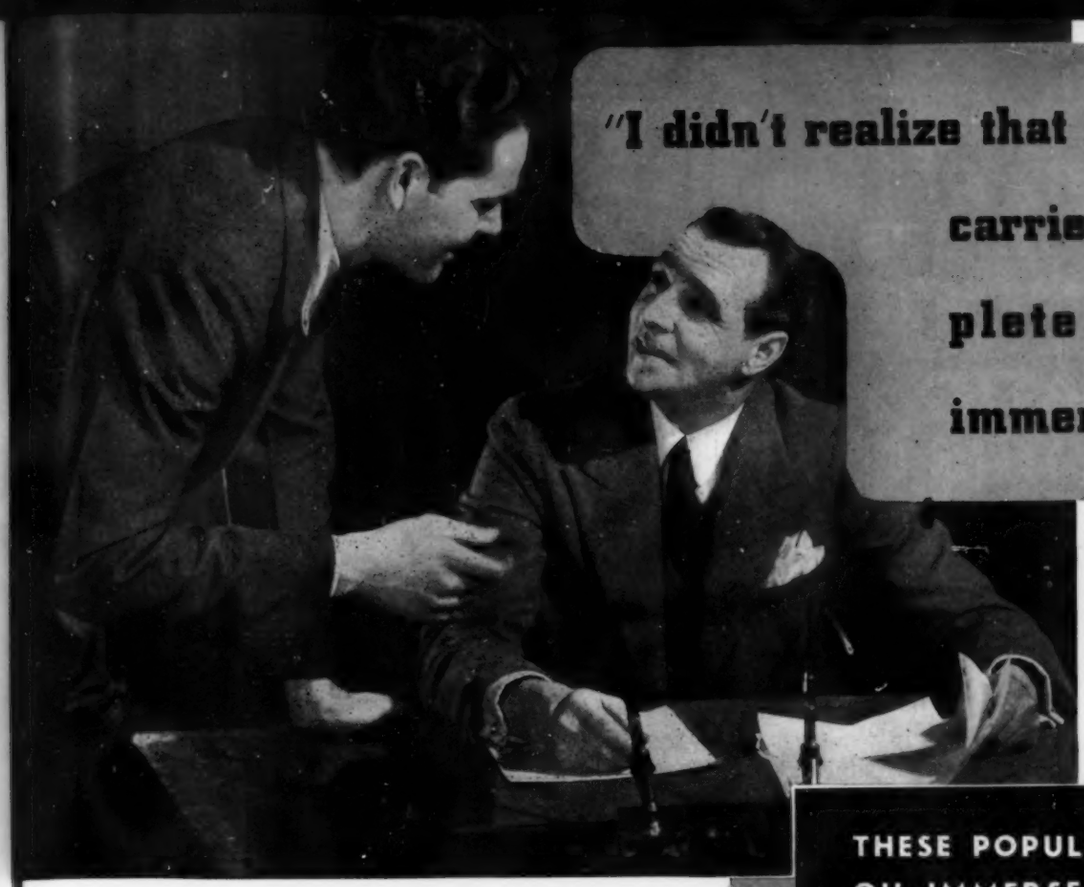
BAUXITE
CEMENT
CEMENT RAW MATERIALS
CHALK
CLAYS
COKE DUST
FELDSPAR
FLINT
FLUE DUSTS
FULLERS EARTH
GLUTEN FEED
GRAPHITE
GYPSUM
KAOLIN
LIME
LIMESTONE
MANGANESE DIOXIDE
PHOSPHATE ROCK
SODA ASH
SODIUM BICARBONATE
STARCH

FULLER-KINYON, FLUXO, AND AIRVEYOR CONVEYING SYSTEMS · · · ROTARY FEEDERS AND DISCHARGE GATES
ROTARY AIR COMPRESSORS AND VACUUM PUMPS · · · AUTOMATIC BATCH WEIGHERS · · · BIN SIGNALS

**FULLER COMPANY**
CATASAUQUA, PENNSYLVANIA

Chicago: 1118 Marquette Bldg. San Francisco: 320 Chancery Bldg.

P-28



# "I didn't realize that ONE company carried such a complete line of oil-immersed control"

WITH the particular requirements of the chemical industry in mind, G-E engineers in the past few years have developed a line of oil-immersed control that is as complete as can be obtained anywhere.

Today, G-E oil-immersed control is available in a wide range of types and sizes for applications in chemical plants where alkaline or acid fumes make corrosion-resisting equipment necessary for the maintenance of continuous operation.

See what all these types give you:

**1.** Increased protection against interrupted production caused by motor shutdowns — all arcing contacts and other moving parts, *including the temperature overload relay,* are submerged in oil. Air and moisture cannot reach them.

**2.** Protection against overheating of the motor—by means of a highly efficient induction temperature overload relay which follows the motor heating characteristics.

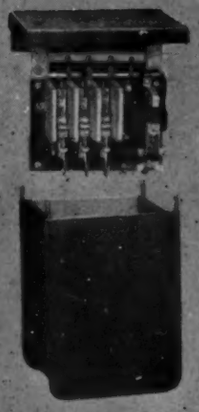
**3.** Ease of installation — interchangeable fittings at the top of the larger controllers for conduits of any size. Conveniently located, clearly marked terminals directly beneath conduit entrance.

**4.** Ease of inspection — the tanks of the wall-mounted types can be easily lowered, thus making all parts accessible.

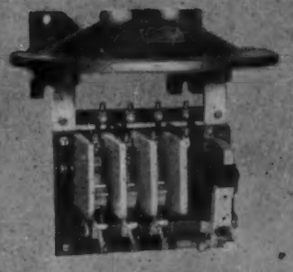
These and other features are strong assurances that operations will be kept continuous, over a long period of time, regardless of the conditions under which they are carried on.

G-E oil-immersed control is also available in explosion-proof design for use in Class I, Group D, hazardous gas locations. Whatever your requirements, G-E engineers will be glad to study them and to make recommendations. Just call the nearest G-E office. General Electric, Schenectady, N. Y.

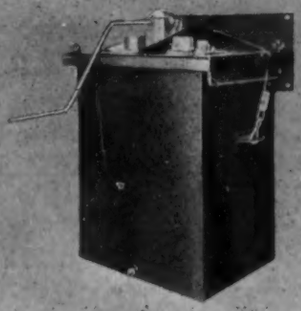
## THESE POPULAR TYPES OF G-E OIL-IMMERSED CONTROL GIVE LONG SERVICE IN CORROSIVE ATMOSPHERES



General-purpose low-voltage magnetic switch, Type CR7006. Has wide application on a variety of jobs



Explosion-proof switch (without oil tank), Type CR7006-B3B. For Class I, Group D, hazardous gas locations



Full-voltage starter for 2300-volt motors. Type CR7006-R1A. Note the tank-lifting mechanism, which aids in making inspection easy

Full-voltage starter with oil-blast contactor, for 2300- to 4600-volt motors, Type CR-7006-C4C. Will interrupt 50,000 kva

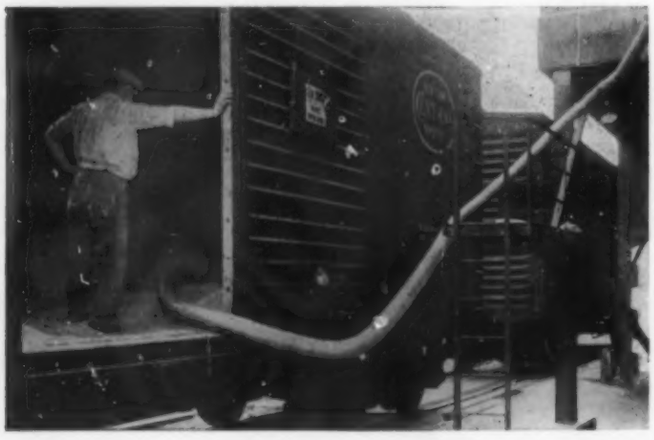
# GENERAL ELECTRIC

080-140

# How Many of the 10 Advantages *will* DRACCO PNEUMATIC CONVEYORS GIVE YOU?

Write for Bulletin No 526

DRACCO Pneumatic Conveyors offer any Chemical Plant 10 possible advantages. The number that you can benefit by depends upon materials handled, distances, and many other factors—but the surprising thing is that nearly all installations enjoy most of the following 10 advantages: (1) control of dust when transporting powdered material, (2) continuous automatic operation, (3) low maintenance cost, (4) labor saving, (5) improved working conditions, (6) lower cost of material due to receiving same in bulk, (7) saving in cost of packaging, (8) no loss of material in handling, (9) no contamination, (10) no interfering with the existing machinery.



**You Can't Beat the DRACCO Way**

**Write for Bulletin No 526**

No matter what the nature of your conveying problem may be you are requested to consult DRACCO Engineers. They have over 20 years of practical experience to draw upon and can give you sound constructive advice. You should have a copy of Bulletin No. 526.

• For Further Information Write •

**DRACCO CORPORATION**

Successors to The Dust Recovering & Conveying Co.

4071 E. 116th St., Cleveland, O. • New York Office, 130 W. 42nd St.

PNEUMATIC CONVEYORS • DUST COLLECTORS



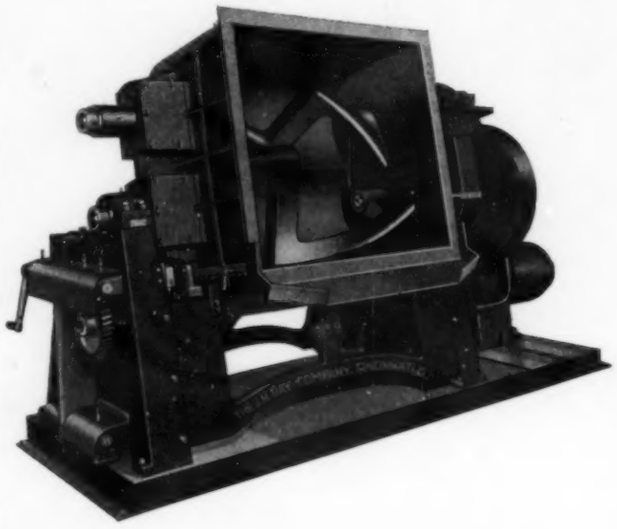
# DAY CINCINNATUS MIXERS

FOR HEAVY DUTY

MIXING

MASTICATING

PLASTICIZING



**DAY NO. 9 CINCINNATUS MIXER**

**WORKING CAPACITY 200 GALLONS**

**TILTING TANK INSURES QUICK DUMPING**

The only mixer on the market today with overlapping agitators. Will thoroughly mix, masticate or plasticize in the shortest period of time.

This mixer can be equipped with heatable agitators, with jacketed tank for heating or cooling, and with vacuum cover. It can also be constructed with a stationary bowl having poppet type valves for discharge of materials.

Ask your nearest DAY representative for recommendations to meet your problem.

**THE J. H. DAY COMPANY**

*Factories and Principal Offices*

**CINCINNATI OHIO**

# THIS LIQUID SCREEN

Screens available in capacities of a few hundred to upwards of ten thousand gallons per hour. Mesh may be any size and of any metal.

## *EXTRACTS THE SOLIDS FROM LARGE VOLUMES OF LIQUID*

The Robins Liquid Screen is successfully used in separating solids from sewage and chemical sludge, fish oil and other liquids. It offers the most economical method of extracting solids from liquids especially when the percentage of solid content is very low.

The rapid vibration of the fine mesh screening surface causes the solids to travel along the screen and allows all of the liquid to pass through it. This screen is lower in first cost and lower in operating cost than any other known equipment capable of performing the same function.

Let us know the nature of your separation requirements and we will gladly advise you as to the recovery percentage and cost of doing the job with a Robins Liquid Screen.

***ROBINS MAKES***

*Belt Conveyors and all their accessories, Belts, Idlers, Trippers, Bucket Elevators, Screens, Screen Cloth, Feeders, Gates, Mead - Morrison Hoists and Grab Buckets.*

MATERIAL HANDLING ROBINS EQUIPMENT

**ROBINS CONVEYING BELT COMPANY, 15 Park Row, New York, N. Y.**

We handle about ..... gallons per hour of ..... with ..... percent of solids, about ..... mesh. Please send us particulars of suitable screen.

Name..... Firm.....

Address..... City..... State.....

**MICROME 1**
*(16% CR)*
**MICROME 2**
*(20% CR)*
**MICROME 3**
*(28% CR)*
**MICROME 4**
*(13% CR)*
**MISCO "B"**
*(24% CR—12% NI)*
**MISCO "C"**
*(29% CR—9% NI)*
**MISCO "18-8"**
*(18% CR—8% NI)*
**MISCO "18-8 Mo."**
*(18% CR—8% NI—3% Mo.)*
**MISCO "HN"**
*(65% NI—15% CR)*
**MISCO METAL**
*(35% NI—15% CR)*
**MISCO "N"**
*(20% NI—10% CR)*

Carbon content and stabilizing additions as indicated by service requirements.

Member Alloy Casting Research Institute

# MISCO

## Heat and Corrosion Resistant CASTINGS

MISCO produces many unusual castings and structures for use at high temperature;—centrifugally cast headers and manifolds for instance—Recently Misco perfected a process by which special shapes such as I-beams, channels, and tees are cast centrifugally — A 900 pound stainless steel valve stem—A complete fractionating tower for a large oil refiner. These are some of the jobs which have established Misco as a leader in an industry. If it can be made in a stainless or heat resisting alloy *Misco can make it.*

MISCO
Heat and Corrosion Resistant Alloys

*Misco "C" fractionating tower built for E. B. Badger & Sons Co., Boston, Mass. Shell centrifugally cast. Bubble trays, caps, and fittings cast in stationary molds.*

**MICHIGAN STEEL CASTING COMPANY**
*One of the World's Pioneer Producers of Chromium-Nickel Alloys*
**1983 GUOIN STREET, DETROIT, MICHIGAN**

## The SARCO Inverted BUCKET TRAP

When you want to handle unusual volumes of condensate fast—when you want a steam trap that will work under the most severe conditions or the highest steam pressures—try the Sarco Inverted Bucket Trap.

Here are some of the reasons why it is working satisfactorily where other traps failed: It is built to "take it," of cast-iron, semi-steel, or forged steel, depending on the pressures, and with renewable valve seats and heads of stainless steel.

It is protected by a Sarco Strainer built inside the trap, and in the larger sizes can be equipped with thermostatic air by-pass which assures rapid and complete elimination of air and gas, regardless of pressure fluctuations.

Write for Catalog No. 165 or this new data book.

STEAM HOOK-UPS

SARCO
THERMOSTATIC, FLOAT AND BUCKET TRAPS, REGULATORS AND HEATING SPECIALTIES

SARCO COMPANY, INC., 183 MADISON AVENUE, NEW YORK, N.Y.
SARCO CANADA, LTD., FEDERAL BLDG., TORONTO, ONTARIO

## EFFICIENT SEPARATIONS FAST—By *Air Flotation*

The SS&S Air-Float Table separates dry granular, ores, minerals and other minerals—dry. Water flotation often makes unwanted changes in material; slows down production, because of quantity of water which must be handled. The SS&S Air-Float Table makes its separations during a process of air-flotation of the material, stratifies it according to relative density, or specific gravity. Using no water, deck load is 100% working material. The process is fully automatic during operation; simple, easily adjustable for different materials or mixtures, or different separations from the same mixture. Water tables need practically one point's difference in specific gravity between materials to be separated, e.g.: 2.70 from 3.70. However, particles fall in air 100 times faster than in water; hence, stratify swiftly on the SS&S Air-Float Separator. Thus separations with difference in s.g. as little as ⅛ of 1 point are easily made, e.g.: 1.95 from 2.20.

**Example:** Reclaiming Filter Material — removal of inert matter, debris, etc., from fullers earth, bone char, etc., permits continued use of the material with nominal loss. Widely used in refining oil, petrolatums, sugar, etc.

**Example:** Grading of Abrasives—removes — "flats" and "spikeys," thus increasing bulk density of material, improving abrasive quality. Almost "standard equipment" in abrasive plants of U. S.; also many foreign countries.

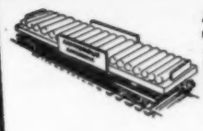
**Example:** Ore Concentration — Pyrite, Galena, Chrome, Wolframite, Scheelite, Bauxite, Manganese, placer Gold sands, Ilmenite sands, Phosphate rock, Asbestos, etc. Requiring no water, it is indispensable in many mining localities lacking water supplies.

The SS&S process of air-float separation is in use in 47 states of the U. S. and 23 foreign countries; working (conservatively) 42 million tons annually of materials such as ores and minerals, coal, dry chemicals, seed and cereals, legumes, nuts, coffee, tea, ground cork, tobacco, bagasse, drugs, spices, abrasives both natural and artificial, raw and finished commercial products of many different kinds, the recovery of usable material from waste, etc. The SS&S Air-Float Table is built in a wide variety of types, sizes and adaptations to specific jobs; handling a range, in size of particle, from 2½" to 200 mesh; in capacity, from a few pounds to 150 tons per hour.

Sutton, Steele & Steele, Inc., maintain a laboratory devoted exclusively to separations problems and backed by 50 years' experience; maintain field engineers in all principal industrial sections, fully qualified to analyze your separations problem. Write for interview, or send for Bulletin CM 812, for complete details.

**SUTTON, STEELE & STEELE, INC.**
**Dallas, Texas**

*In Canada:* KIPP KELLY, LTD., 68 Higgins Ave., Winnipeg.
*Foreign:* SEPARATIONS ENG'RING, LTD., 133 Bush House, Aldwych, London



Ammonia Vapor and a lot of sticky residue to be removed. After a year on this job, Cuno filters are working perfectly. Line pressure is 15# per square inch. Flow is 40 cubic feet per minute.

Pigment in tire paint was clogging nozzles in the system. Cuno filters were installed and prevented further clogging — but nothing collected in the filters' sumps. Pigment actually broke up, was re-mixed, and went through!

Carbonized particles must be removed from caramel syrups used in the manufacture of flavoring materials for soft drinks and other beverages. Cuno Filters are used as roughing screens before final filter press operation.

One division of a large chemical company wanted efficient removal of dried particles from nitro-cellulose jelly used in the manufacture of artificial leather. Cuno is straining 20 g.p.m. of the material. Viscosity: 21,000 centipoises at 34° C.

See our exhibit at the Thirteenth National Exposition of Power & Mechanical Engineering, Grand Central Palace, New York, December 5 to 10, 1938.

# Teardrops or Torrents — *cleaned by Cuno*

Cuno *continuously cleanable* filters have so wide a range of sizes — they strain small amounts of fluid just as effectively as thousands of gallons per minute. Widely approved throughout industry because of their ability to do their filtering jobs without large losses in pressure — Cuno filters have made ordinary "screening" — ancient. No more shut-downs for cleaning . . . no more duplexing necessary.

The kind of fluid you have, whether air, oil, water, acid, or anything else — and the kind of solid *in* the fluid — is all we need to know to make a recommendation to you. Or perhaps you have a fluid that has never been filtered? In that case, we'll gladly work on it in our own laboratory, without obligation to you.

The column at the left is to give you a rough idea of the variety of Cuno applications. And the coupon below is to bring you up-to-date continuous straining information.

Cuno's types of continuously cleanable filters — Auto-Klean and Flo-Klean have many sizes, strain two or three gallons per minute — or many thousand gallons. Made in any corrosion-resistant machinable metal, they operate over wide ranges of temperature, viscosity, and pressure; and they are all adaptable to special jobs. Our engineering service and laboratories are at your disposal, of course.

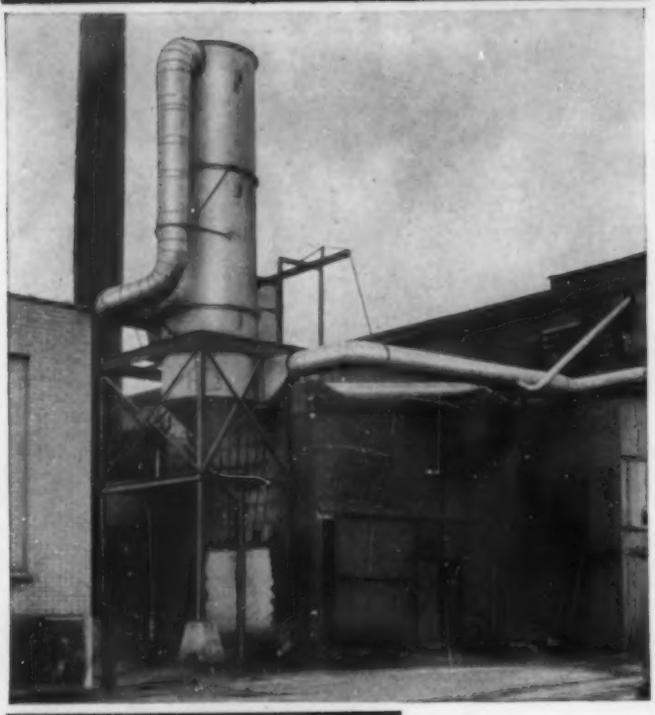
Cuno Engineering Corporation
188 South Vine Street
Meriden, Connecticut.
Please send me free bulletins on Cuno filters.

Name .....
Company ..... City ..... State .....
Street .....
☐ I'm interested in your engineering service. (Check if you'd like information on this.)

*call* **CUNO** *your filtration engineers*

CUNO ENGINEERING CORPORATION ★ MERIDEN, CONNECTICUT

# SCHNEIBLE MULTI-WASH



## DUST COLLECTORS *are so Simple It's Amazing!*

Most dust collection systems that anywhere near approach the Schneible Multi-Wash in efficiency are so complicated and troublesome that plant operating men are amazed at the simplicity of the Schneible Multi-Wash. And yet, it is this very simplicity that accounts for its high efficiency and low cost operation without interruption. Simplicity that eliminates maintenance!

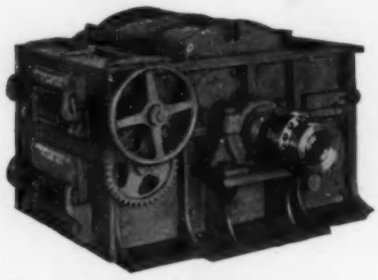
The Schneible Multi-Wash Dust Collector uses no bags, screens or filters—no moving parts—nothing to wear, break, burn or clog—nothing to get out of order—just water, or some other cleansing liquid at no head pressure, is used over and over again as the washing medium.

The Schneible Multi-Wash System is not an experiment—Bulletin 110 tells about 60 successful installations in "blue book" plants. Hundreds of others are used throughout industry. They are made in Junior and Senior sizes from 1,500 to 30,000 c.f.m.

Available in corrosion-resistant metals and rubber-lined or chemically treated steel or cast iron. There's a type and size for every dust and fume suppression service. Your local Schneible Sales Engineer will be glad to give you further facts.

**CLAUDE B. SCHNEIBLE CO.**
DUST SUPPRESSION ENGINEERS
3951 LAWRENCE AVENUE, CHICAGO — OFFICES IN PRINCIPAL CITIES

# Grinding Equipment
## *for* ALL KINDS *of* CHEMICALS



AMERICAN FINE GRINDER

AMERICAN RING and HAMMER TYPE CRUSHERS are used by leading Chemical Plants for Primary and Secondary Crushing. These machines have a wide operating range and are very flexible.

*Tell Us Your Problems*

AMERICAN PULVERIZER COMPANY
1219 MACKLIND AVE., SAINT LOUIS
Originators of the ROLLING RING CRUSHER PRINCIPLE

# 33 FEATURES FOR BETTER SERVICE *in these NEW valves*

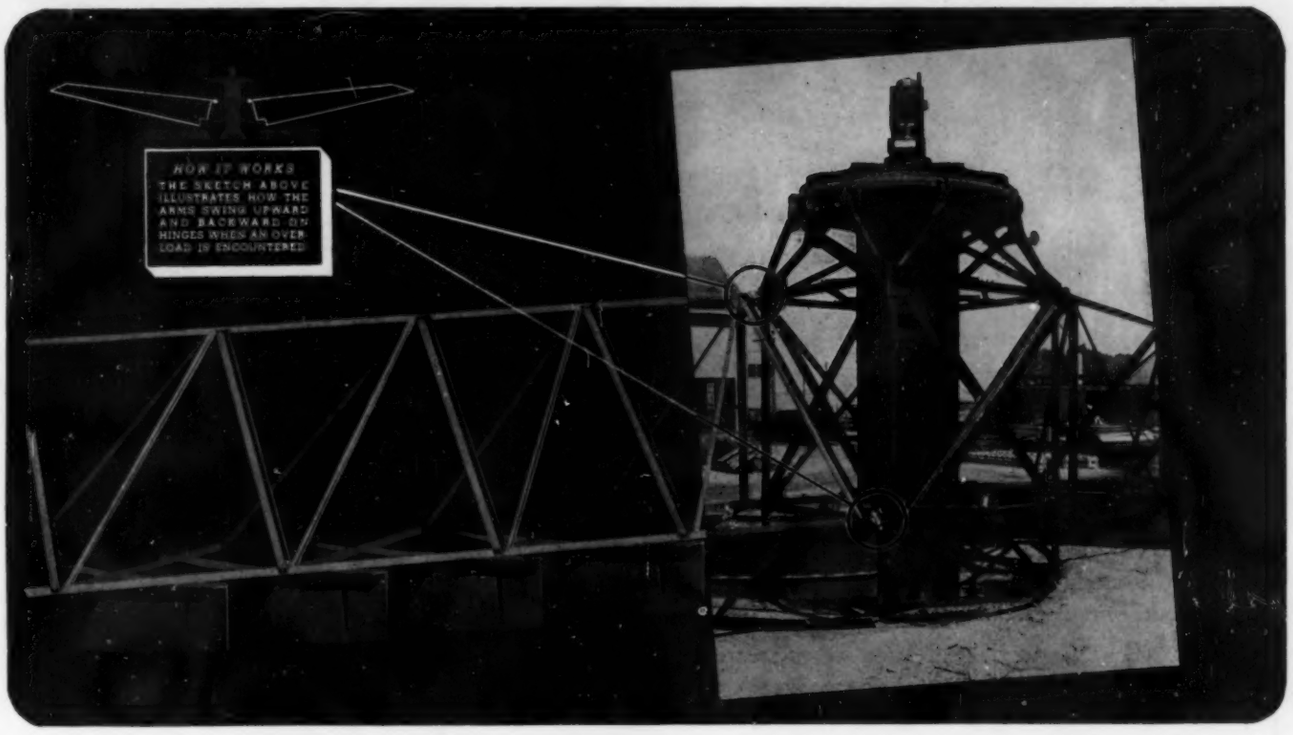
STRONGER metal, more stem contact threads, bronze bushings at all stem contact surfaces, larger hand-wheels, wider seat and disc ring faces, and extra conveniences for connecting up, repacking and making adjustments—these are some of the 33 special features of the new Kennedy Standard Iron-body Wedge Gate Valves. This important advance in valve design is fully described in bulletin which will be sent on request.

THE KENNEDY VALVE MFG. CO.
Elmira, N. Y.

*Write for Bulletin* describing the 33 Features

**KENNEDY**
STANDARD IRON-BODY *Wedge* GATE VALVES

# DORR TORQ THICKENERS


HOW IT WORKS
THE SKETCH ABOVE ILLUSTRATES HOW THE ARMS SWING UPWARD AND BACKWARD ON HINGES WHEN AN OVERLOAD IS ENCOUNTERED

## THRIVE ON A VARIABLE FEED

THE DORR TORQ THICKENER takes in its stride the bad going with the good. Its automatic "knee action" rakes step high over overloads, protecting the entire mechanism against stalling, bending or breakage.

If the going gets tough and the torsional load mounts, up swing the arms, pivoting at the center. As the overload is reduced and the torsional load decreases, the arms swing down to their normal operating positions.

No ploughing bodily through overloads. No unnecessary straining or twisting of the machines. No manipulation of a rake lifting device.

You can sleep contentedly on the night shift with a Dorr Torq Thickener on the job.

DORRCO

**A CASE STUDY OF AUTOMATIC OVERLOAD RELIEF**

*The Machine:*
A 50 ft. x 10 ft. Dorr Torq Thickener.

*The Operating Conditions:*
Feed—250 tons per day—4.4 sp. grav. ore—95% minus 325 M 4:1 dilution.

*The Overload:*
An 8 hour power shut down, 700 tons of slurry, 82% solids, packed 5 ft. above rake arms.

*The Relief:*
"They started the thickener mechanism and looked for the worst to happen—either bent or broken rakes—To their complete surprise the Torq arms lifted about 1½ feet vertically and then started forward without any trouble whatsoever."
—I. W. J.

THE **DORR COMPANY** INC.

**ENGINEERS • 570 Lexington Ave., New York**

ATLANTA • TORONTO • CHICAGO • DENVER • LOS ANGELES

DORR TECHNICAL SERVICES AND EQUIPMENT ARE ALSO AVAILABLE FROM THE FOLLOWING COMPANIES:
NETHERLANDS: Dorr-Oliver N.V. The Hague • ENGLAND: Dorr-Oliver Company Ltd., London • GERMANY: Dorr Gesellschaft, m.b.H. Berlin • FRANCE: Soc. Dorr-Oliver, Paris
ITALY: S.A.I. Dorr-Oliver, Milan • JAPAN: Sanki Eng. Co., Ltd., Tokyo • SCANDINAVIA: A.B. Hedemora, Hedemora, Sweden • AUSTRALIA: Crossle & Duff Pty. Ltd., Melbourne
ARGENTINA: Luis Fiore, Buenos Aires • SOUTH AFRICA: Edward L. Bateman Pty. Ltd., Johannesburg • BRAZIL: Oscar Taves & Co., Rio de Janeiro

# WHY SHOULD YOU PAY FOR THE DUST HOG'S BILL-OF-FARE?

- LOSS OF TIME FOR REPAIRS
- DAMAGE TO MACHINERY
- DAMAGE TO PRODUCTS
- COST OF MAINTENANCE
- ETC. • ETC. • ETC. • ETC.

As long as dust is in your plant you pay and pay and pay! It smudges finished products, dirties shops and equipment, and dulls the pride of good workmanship.

Pangborn engineers have had many years successful experience controlling the dust nuisance in industry. If you have a dust problem--let Pangborn show you how to economically--

**CONTROL THE "DUST HOG"!**

*Write For Dust Control Literature*

**PANGBORN**

THE WORLD'S LARGEST MANUFACTURER OF DUST CONTROL AND BLAST CLEANING EQUIPMENT

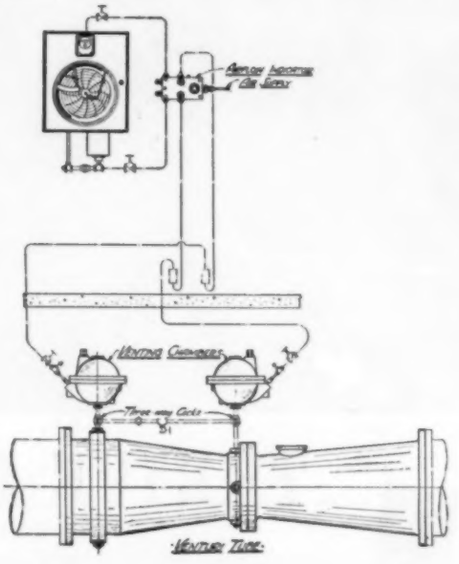
PANGBORN CORPORATION · HAGERSTOWN, MD.



**SPECIFY SIMPLEX**

**AIR DIFFERENTIAL METERS**

for accurate measurement of corrosive fluids.



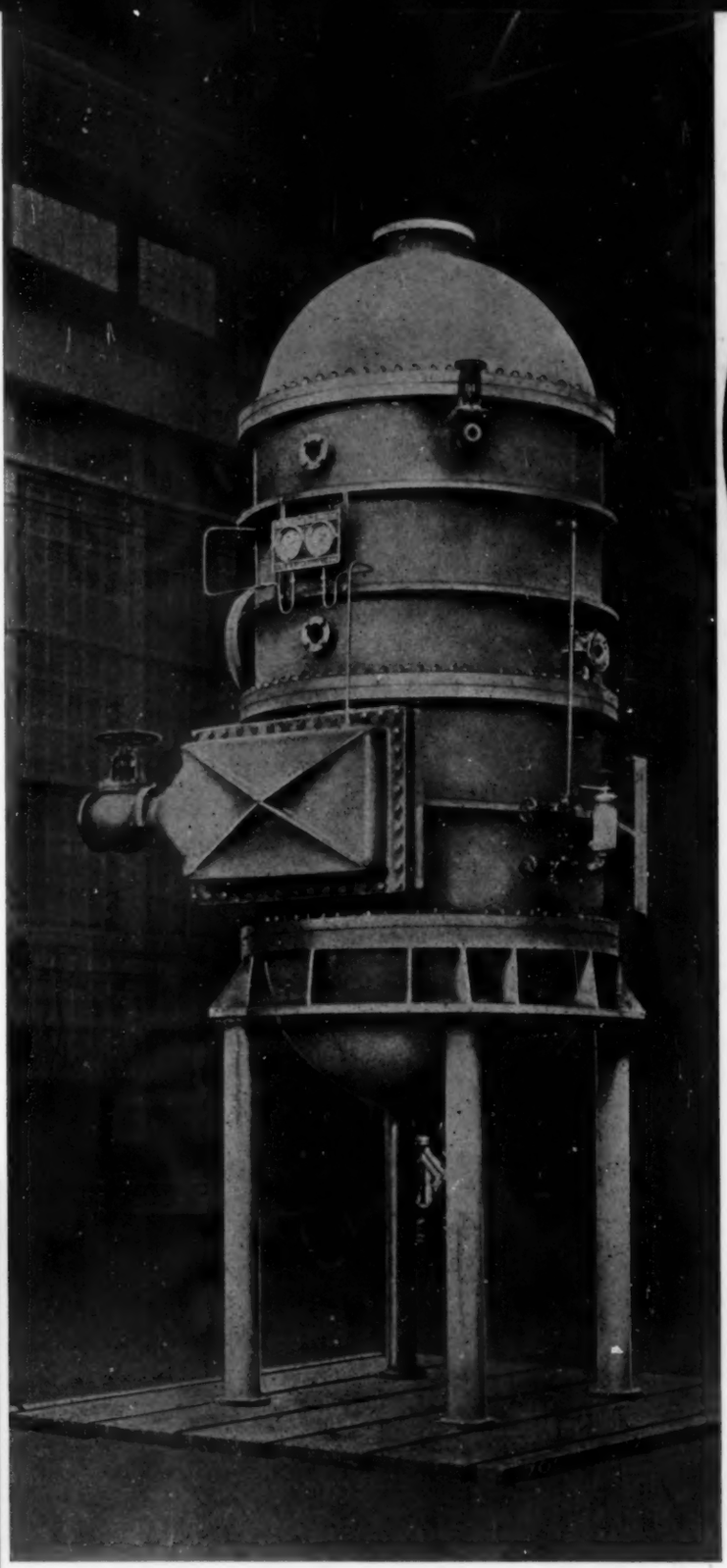
THE SIMPLEX AIR - DIFFERENTIAL METER — provides an accurate, dependable and sensitive means of metering your most corrosive fluids. The use of standard metering equipment reduces both first cost and maintenance expense.

Proven by years of service under the most rigorous conditions, SIMPLEX AIR - DIFFERENTIAL METERS will satisfy your most rigid requirements.

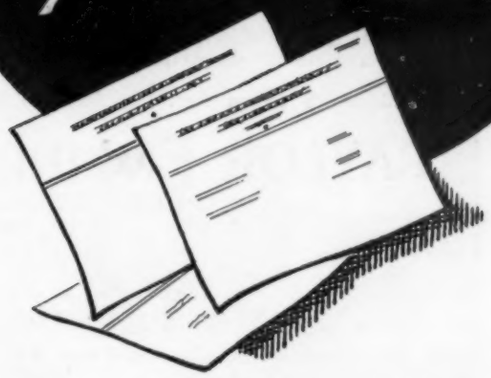
LET SIMPLEX ENGINEERS AID YOU IN YOUR MEASURING PROBLEMS

**SIMPLEX VALVE AND METER CO.**

6800 Upland St. Philadelphia, Pa.



# *Satisfaction is best expressed by Repeat Orders*



Used in the concentration of a product that contains free sulphuric acid, this Struthers-Wells All-Cast Lead Evaporator was built several years ago for a large chemical company. Today we are duplicating this installation for the same company which shows that this piece of equipment has operated entirely to the customer's satisfaction.

Cast in our own foundries, it is equipped with seamless copper, lead-covered horizontal tubes. The tube plates are of steel plate with a perfectly bonded lead coating on the inside to resist acid corrosion.

It is a typical example of the many types of Struthers-Wells equipment available for the process industries.

## STRUTHERS-WELLS EVAPORATORS

*INCLINED, VERTICAL TUBE, HORIZONTAL*

*FORCED CIRCULATION*

**STRUTHERS-WELLS**

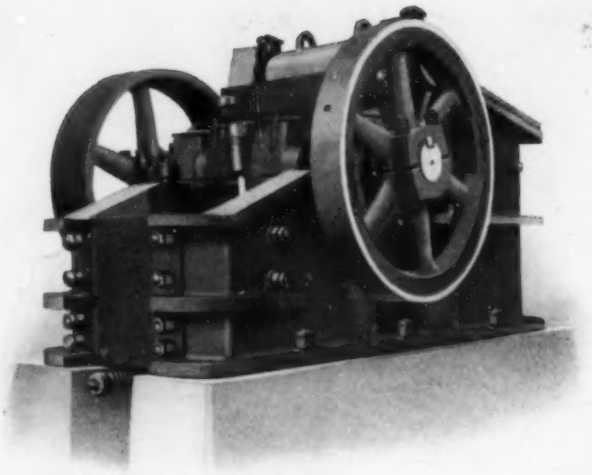
EVAPORATOR DIVISION

TITUSVILLE, PENNA.

*many companies in the process industries use*

# TRAYLOR

## *JAW CRUSHERS with great satisfaction — and PROFIT!*



● At least, that's what they've been telling us for years, and proving their statements by the very best of criterions—re-orders.

● We mention these facts to induce others, not using or acquainted with TRAYLOR Jaw Crushers, to investigate them. We are satisfied that such examinations will produce the results we desire. *Send for our literature on Jaw Crushers—today!*

**TRAYLOR ENGINEERING & MANUFACTURING CO.**
*ALLENTOWN, PENNSYLVANIA, U.S.A.*

**NEW YORK CITY** 3916 Empire State Bldg. **CHICAGO** 815 One La Salle St. Bldg. **SALT LAKE CITY** 101 West Second South St. **LOS ANGELES** 919 Chester Williams Bldg. **SEATTLE** 6311-22nd Ave., N. E.

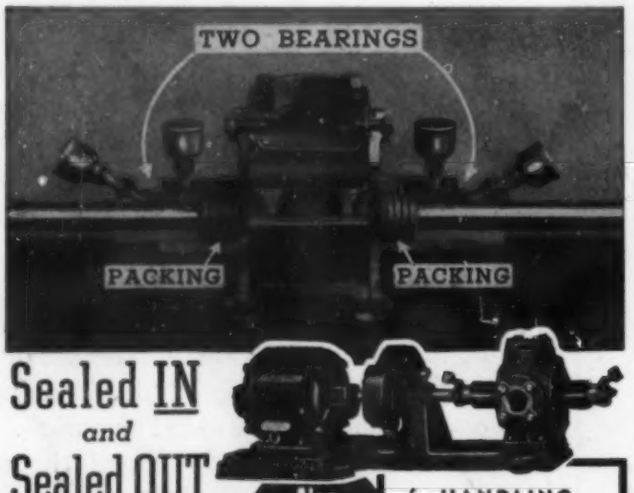
**THE CANADIAN FAIRBANKS-MORSE CO., LTD.** 980 St. Antoine St., Montreal, P. Q., Canada

**B. C. EQUIPMENT CO., LTD.** 551 Howe St., Vancouver, B. C.

**MAQUINARIA INTERNACIONAL S. R. L.** Av. Francisco I. Madero No. 17, Desp. 214, Mexico, D. F.

**MANILA MACH. & SUPPLY CO., INC.** Manila and Baguio, P. I.

**Export Department—104 Pearl St., New York City. Foreign Sales Agencies: London, Lima, Sao Paulo, Rio de Janeiro, Buenos Aires, Santiago, Valparaiso, Antofagasta, Iquique, Oruro**




## Sealed IN and Sealed OUT

**No wonder BLACKMER Rotary Pumps give such excellent, long-time service. Note the two-bearing construction, each bearing protected by packing.**

**This packing keeps the pumpage SEALED IN the pump case; the bearing lubricant SEALED OUT. Thus the bearings stay lubricated—the material handled kept clean of oil or grease.**

**With many types and hundreds of sizes, there is bound to be a BLACKMER Pump to meet your specific needs. Profit from our 30 years' experience. BLACKMER PUMP COMPANY, 1840 Century Ave., Grand Rapids, Michigan.**

**Also Hand Pumps 14 Models**

**for HANDLING PRACTICALLY ANY LIQUID or SEMI-SOLID**

| | |
|---|---|
| Acids | Molasses |
| Alcohols | Naphtha |
| Ammonia | Oils - |
| Asphaltum | Crude |
| Beer | Lube |
| Brine | Vegetable |
| Caustics | Coal Tar |
| Creosote | Paraffine |
| Gasoline | Syrups |
| Glue | Tan Liquor |
| Glycerine | Tar (Hot) |
| Grape Juice | Turpentine |
| Lard | Vinegar |

**BLACKMER *Rotary* PUMPS**

EXCLUSIVE BUCKET DESIGN—AUTOMATIC TAKE-UP FOR WEAR

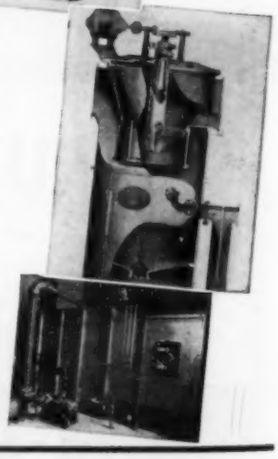
## MURRAY SPRAY WHEELS & WASHERS BASSLER GAS SCRUBBERS

Several designs and applications are shown here. Any design can be made to meet special requirements of an industry. There's a Murray Spray Wheel or Bassler Scrubber for every plant requirement.

How thoroughly this equipment distributes the fine spray is illustrated here.

The spray can be produced fine, medium, or coarse to meet specific applications.

Murray Spray Wheels and Bassler Scrubbers cannot be clogged at any time. They are self-cleaning and fool-proof . . . lowest possible maintenance cost. The type shown here may be installed singly or in multiples on new installations, or as equipment to replace banks of spray nozzle previously used.



This is ideal equipment for breaking up chemicals and materials so necessary in process manufacturing, or for washing gases, etc. Send us your specifications. We'll gladly help you solve your problems.

**D. J. MURRAY MFG. CO.**
*Wausau, Wisconsin*

Powell

# CORROSION RESISTANT VALVES

POWELL CORROSION resistant valves withstand acids, alkalies and chemical solutions. Select Powell valves on your next installation. Make a profitable investment in lengthened valve service and avoid costly shutdowns. The Powell new testing methods and laboratory equipment assures immediate service to your individual problem.

*Write Today*

FOR REVISED POWELL CORROSION CATALOG!

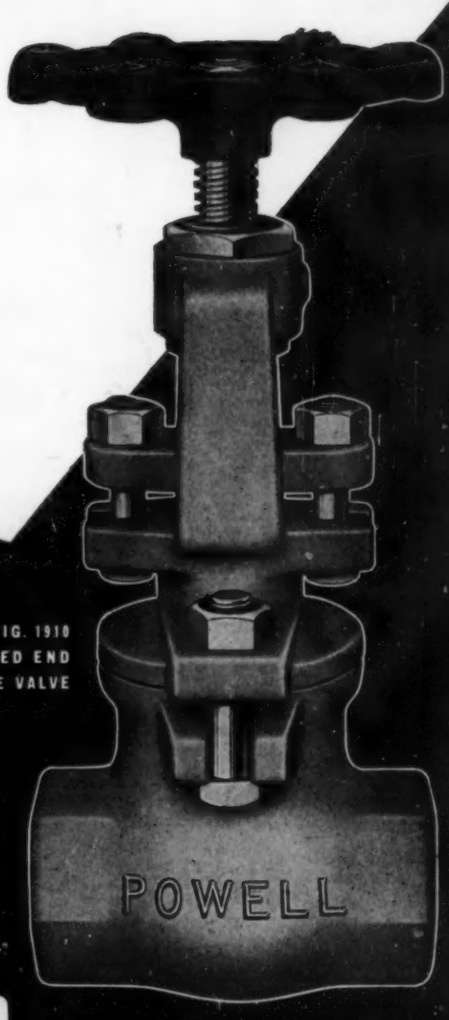



FIG. 1910
SCREWED END
GATE VALVE

POWELL VALVES

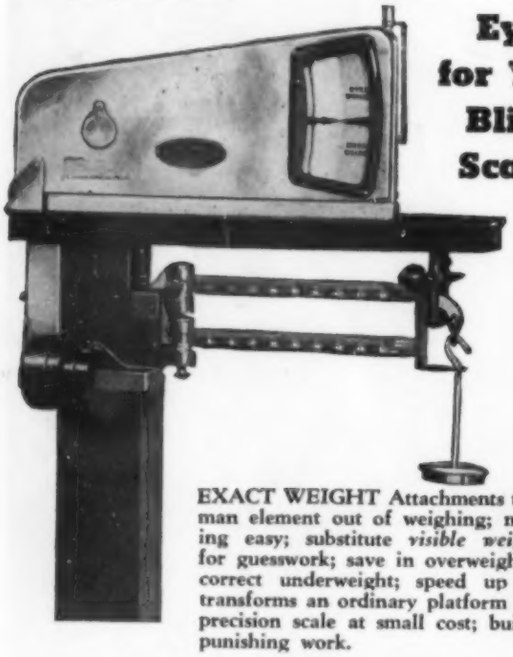
SPECIAL ALLOY VALVE DIVISION • CINCINNATI, OHIO

# Exact Weight Scales

## for Complete Chemical Sacking Operations . . .

The new model EXACT WEIGHT Sacking Scales lick obstinate production costs in bagging operations. They fill, efficiently and accurately weigh bags of free flowing chemicals at the rate of from five 200 lb. bags and eight 100 lb. bags per minute . . . increase sack yield from bulk and accomplish these results with ordinary Plant labor.

*Write for full details and scale specifications*



**Eyes for Your Blind Scales**

EXACT WEIGHT Attachments take the human element out of weighing; make weighing easy; substitute *visible weight control* for guesswork; save in overweight packages; correct underweight; speed up operations; transforms an ordinary platform scale into a precision scale at small cost; built for hard punishing work.

The EXACT WEIGHT SCALE COMPANY

1600 W. FIFTH AVE. COLUMBUS, O.

THERE IS NO SUBSTITUTE FOR EXACT WEIGHT

INDUSTRIAL PRECISION SCALES

SUTORBILT IS WELL BUILT

POSITIVE

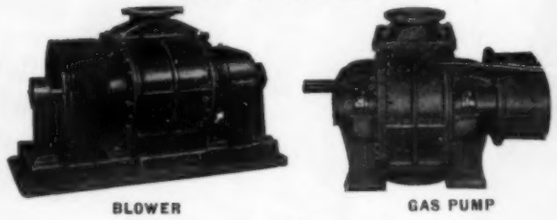
## Blowers and Gas Pumps TRAVEL

TO MANY PARTS OF THE WORLD

**WHY NOT TO YOU?**

Submit Your Air and Gas Handling Problems to SUTORBILT

A SKETCH WILL HELP



BLOWER GAS PUMP

*"Go There For Air"*

K. I. Clisby, 74 TRINITY PL., NEW YORK, N. Y.

PRODUCTS OF SUTORBILT CORPORATION

General Blower Co., 401 N. PEORIA ST., CHICAGO, ILLINOIS

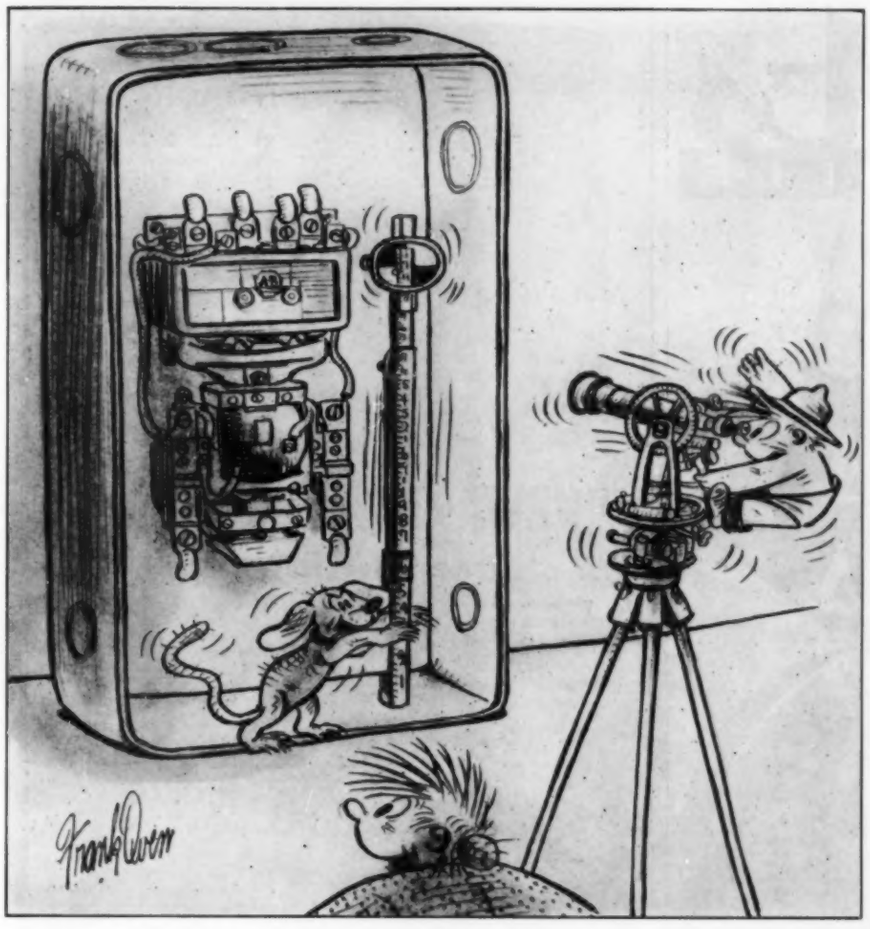
P. O. Box 186—Station K—Los Angeles, California, U. S. A.

## TWO HEADS ARE BETTER THAN NONE

Install the B.S.&B. Safety Head on your pressure equipment and eliminate danger to human life and property. Pressure explosions have no regard for time or place, they occur anytime, anywhere. Safety Heads will protect your workmen and valuable pressure equipment because they are accurate in bursting pressure, durable, "fool proof" and automatic. Detailed recommendations are free.

**BLACK, SIVALLS & BRYSON, INC.**

7502 East Tenth Street Kansas City, Mo.



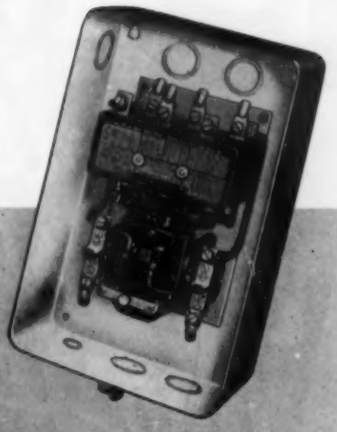
## "Sure, Mama can see there's lots of room in that starter!"

You'll find plenty of room for wiring in this Allen-Bradley solenoid starter—room to do a neat job and do it quickly. Other features, too, help to make installation easy. In dark corners, the white interiors will reflect light and illuminate the starter. The cabinet cover can be removed to be out of the way. All terminals are conveniently accessible from the cabinet front. There are plenty of knockouts on the side and the back of the cabinet.

Maintenance engineers never have to clean or file the double break, cadmium silver alloy contacts on these starters. Because valuable contact life is not filed away, they last many times as long as ordinary contacts.

You will find these starters equal to your very toughest jobs. No other starter is so simple nor has so few moving and wearing parts. You'll assure yourself complete satisfaction if you specify Allen-Bradley starters on your next job.

Allen-Bradley Co., 1337 S. First St., Milwaukee, Wis.



## FIVE REASONS

### why this solenoid starter is ideal for the process industries

**1 NO CONTACT MAINTENANCE**
The double break, cadmium silver alloy contacts never need cleaning or filing. They are always in perfect condition.

**2 SIMPLE AND TROUBLE-FREE**
There are no trouble-causing pivots, bearings, hinges, or complicated mechanisms on the Allen-Bradley starter.

**3 CONTINUOUS SERVICE**
The few, simple starter parts are made rugged and strong. Millions of operations are built into these A-B starters.

**4 EASY TO INSTALL**
Starter has generous wiring space, white interior, accessible terminals, many knockouts, and removable cabinet cover.

**5 SEVEN ENCLOSURES**
Available in standard, water-tight, dust-tight, explosion-proof, and oil-immersed corrosion-proof enclosing cabinets.

# ALLEN-BRADLEY
## SOLENOID MOTOR CONTROL

# Roots
CONNERSVILLE

## Meters Exhausters Boosters Blowers

BACK in the days when the correctness of Roots engineering principles was being proved by application to early gas handling problems, current needs of the Process Industries had not appeared over the horizon. But out of those years of testing and development have come the answers to many a new day gas handling, metering or proportioning problem.

On any job where air or gas is to be handled under pressure or vacuum or where exact measurement or proportioning of gases is required, it pays to call in a Roots-Connersville sales engineer and get the benefit of our years of experience.

ROOTS-CONNERSVILLE
BLOWER CORP.
CONNERSVILLE INDIANA

NEWARK

In addition to quality assurance, users of NEWARK Testing Sieves are never in doubt about the wire diameter, spacing, or sieve number.

*On every NEWARK Sieve there is an amply large label bearing all of the essential figures, plainly, correctly, and permanently stenciled. Even the "enlarged" label shown at the left is SMALLER than actual size.*

## "NEWARK" Testing Sieves *are ACCURATE*

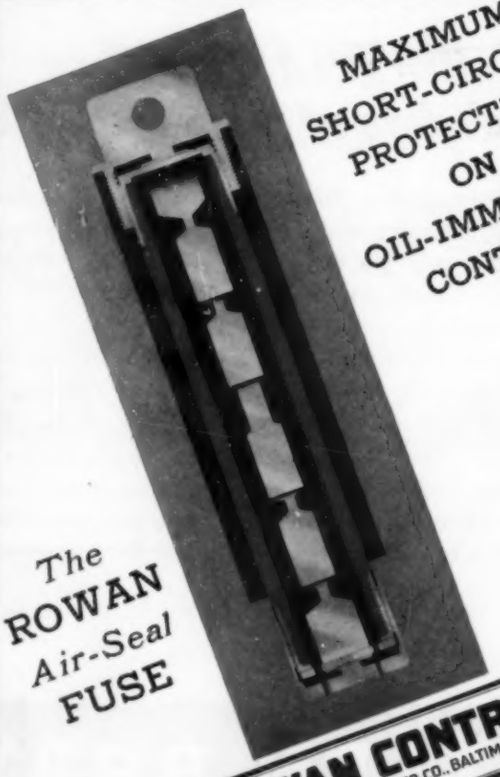
When in need of Testing Sieves on which you can positively *rely*—specify "NEWARK". You will get sieves that are accurate in every detail. Besides you will get these features: No corners or crevices to catch material; Rigid frame; All soldering on outside; Cloth quickly and easily replaced. Complete data on request.

We also manufacture highest quality Wire Cloth in all meshes, weaves, and sizes, of all malleable metals, for every purpose; Filter Cloth; Testing Sieve Shakers; Screens; Riddles; Sifters; and Fruit Testing Sieves. Also SPECIAL WOVEN WIRE PRODUCTS are made to customers' specifications—complete—fully controlled through the entire process. Write us your needs.

**NEWARK WIRE CLOTH COMPANY**
**350-364 Verona Ave., Newark, N. J.**

**Sales Representatives: Chicago, Boston, Detroit, Havana, Houston, Los Angeles, San Francisco, Tulsa**



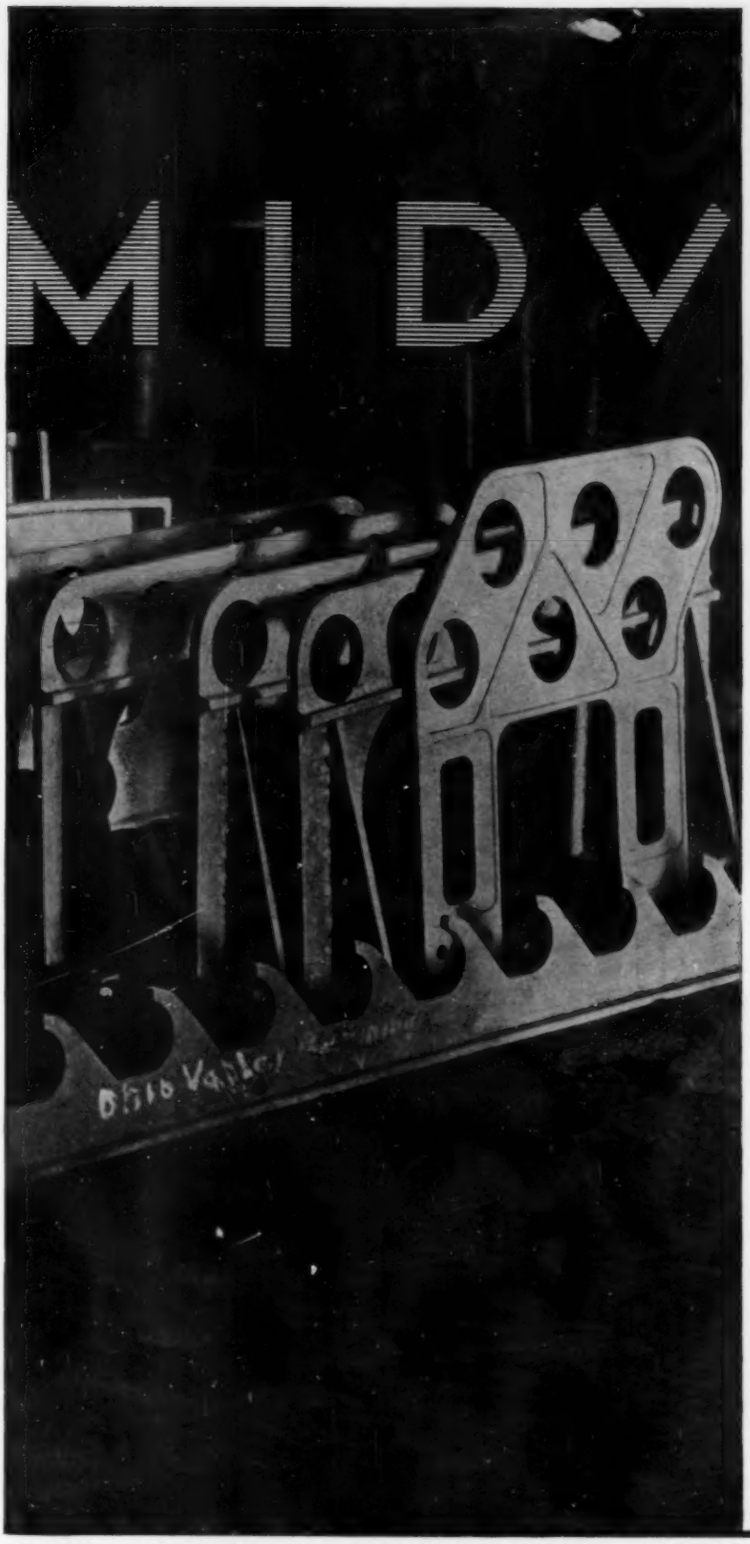


MAXIMUM SHORT-CIRCUIT PROTECTION ON OIL-IMMERSED CONTROL

The ROWAN Air-Seal FUSE

ROWAN CONTROL
THE ROWAN CONTROLLER CO., BALTIMORE MD

★ ★ *Full details will be supplied upon request.*



# MIDVALE

## *Specialization from General Experience*

**True, in the oil field, Midvale has earned a reputation for dependability in those very places where heat and corrosion resistance are a major problem. Just as in the process industries, from large tanks to small pickling racks, various Midvalloys have become standards of excellence.**

**It dates back to the fact that Midvale pioneered in alloys, pioneered in laboratory studies of steel's possibilities, and from long range general knowledge is able to bring specific answers.**

ALLOY CASTING RESEARCH INSTITUTE MEMBER

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For efficient, dividend paying screening installations—submit your problems to Link-Belt engineers.

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You can judge a firm by performance! Our experience in the field of elevated steel water tanks includes a complete line of tanks ranging from 5,000 to 2,000,000 gallon capacity.

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# PULMOSAN *Airtight* RUBBER GOGGLES

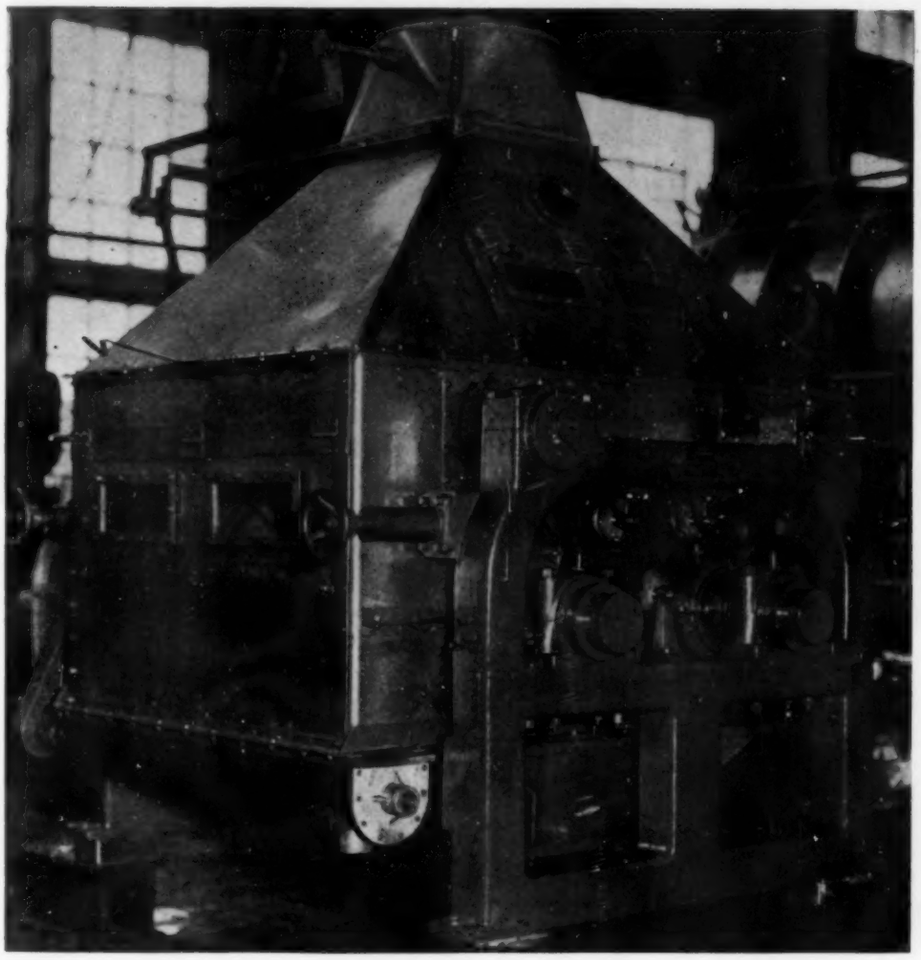
## Protect Against Acids & Chemicals!

- ***Seals out Fumes, Gases, Dusts***
- ***Protects eyes against splashes***

Moulded in one-piece, of non-irritating Para rubber, fitted with lenses 2⅛" in diameter. Perfect, airtight fit. Unaffected by Acids or Chemicals. Standard clear lenses furnished, but available in heavy clear or hardened lenses. Send for a pair of G-520 Rubber Goggles for trial. Or write for further details and prices.

**PULMOSAN SAFETY EQUIP. CORPORATION**

*Dept. CM*, 176 Johnson St., Brooklyn, N. Y.



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***Builds . . . . . .***

**AUTOCLAVES**

**ATMOSPHERIC DRUM DRYERS**

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**VACUUM ROTARY DRYERS**

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**SOLVENT RECOVERY EQUIPMENT**

# CONTINUOUS DRYING

## *Replaces Batch Operation!*

IN drying dyes with BUFLOVAK enclosed Double Drum Dryers, continuous low cost drying replaces batch operation. The liquid material is fed to the dryer and leaves a few seconds later as a dry product. Improvement in product results from short exposure to the heating surface and uniform drying.

Production costs are lowered by the reduction in direct labor, through eliminating handling of pans and trays. Frequently, grinding operations are unnecessary. This compact dryer also saves floor space.

Dust hazards are avoided by completely enclosing the dryer in a Monel metal casing—an indispensable feature where toxic materials are handled.

Different dyestuffs can be successively dried because all parts are accessible for thorough and easy cleaning.

The dryer is equipped with a pendulum feed and many other basic patented features. All operating controls are conveniently located.

The profit-building advantages of drum drying are being brought to a constantly growing number and kind of products by new BUFLOVAK developments. In this range, may be the profitable solution of your drying problem. *Confidential recommendations from the BUFLOVAK Research Staff are available without obligation.*

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# BUFLOVAK DRYERS

# FREDERICK

IS THE NAME TO REMEMBER
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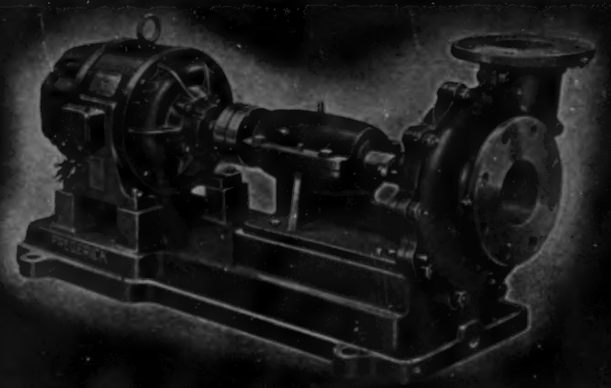
# PUMPS

ON ANY CHEMICAL JOB

MANUFACTURERS OF PUMPS, INDUSTRIAL AND DOMESTIC STOKERS

**FREDERICK IRON & STEEL CO.**

Dept. E FREDERICK, MARYLAND



# BRASSERT *Automatic* STRAINER

REMOVES SUSPENDED SOLIDS FROM LIQUIDS, OPERATES CONTINUOUSLY AND AUTOMATICALLY—STRAINER OPENINGS FROM 1/16" TO 1/64" AND AT LOWER CAPACITY, FROM 1/64" TO .003"—SIZES FROM 2" LINE CONNECTION UP TO 30".

30-Inch Strainer

Water enters connection at one side of strainer and leaves from the side opposite through a similar opening. Straining elements are porcelain discs perforated by tapered parallel holes inserted in holders in the walls of a cast iron cylinder. Rigid alignment is secured by roller or stellite bearings. Water passes from outside of cylinder to center, thence to outlet. Cylinder is slowly revolved either continuously or occasionally, and strainer discs are back washed into waste compartment once each revolution. About 5% of clean liquid is used in backwashing. Differential pressure between clean compartment and waste compartment is adjustable. Strainer is adapted to granular material and also to fibrous substances which clog an ordinary strainer. Speed or frequency of revolution is adjustable to suit the necessities of solid removal. A large number of strainers are in use in very exacting services.—*Write for Bulletin*—C

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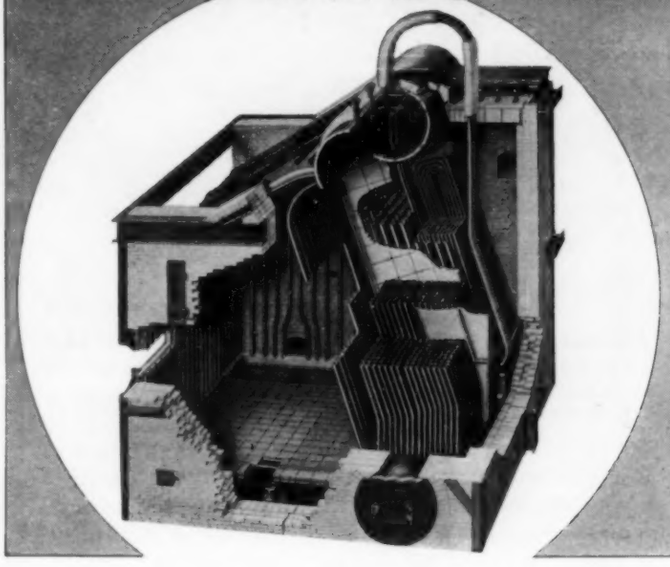
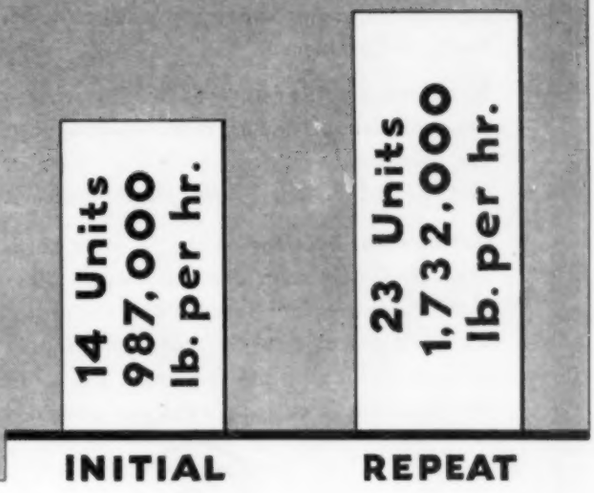
B & W INTEGRAL-FURNACE BOILER






# A Chart of Sales... and Satisfaction

The successful performance of 14 B&W Integral-Furnace Boilers in the process industries, has resulted in repeat orders for 23 additional units. In terms of combined capacity, 987,900 pounds of steam per hour is being expanded to 2,720,-500 lb. per hr.—a 175 per cent increase.

Altogether the process industries have ordered a total of 107 units of this type, totalling nearly eight million pounds of steam per hour. Among the industries represented are soap, textiles, paper, pulp, food, and chemicals. One manufacturer started with three small units; today nine B&W Integral-Furnace Boilers, with nearly 380,000 lb. per hour total capacity, are installed or on order for this company.

Bulletin G-17-A gladly sent upon request.

THE BABCOCK & WILCOX COMPANY . . . . 85 LIBERTY STREET . . . . NEW YORK, N. Y.

G-148

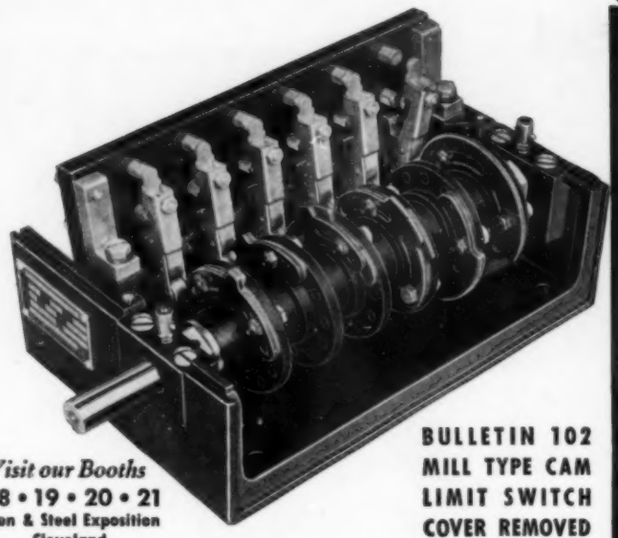
BABCOCK & WILCOX

## COMPACT—
## BUT NOT CROWDED!

This Bulletin 102 Heavy Duty, Mill Type Cam Limit Switch while compact, provides plenty of Electrical Clearance.

It's a new addition to the "3C" line of dependable controls and its contact wearing parts are completely interchangeable with similar parts on "3C" Bulletin 101 Mill Master Switches.

Needle roller bearings on the ¾" case hardened steel main shaft are mounted in brass blocks. Remove four screws, and the entire shaft and cam assembly lifts out of the housing without disturbing the fingers on the Slate Mounting. That's compact—but not crowded!



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Iron & Steel Exposition
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**BULLETIN 102**
**MILL TYPE CAM**
**LIMIT SWITCH**
**COVER REMOVED**

*Sturdy cast iron, drip-proof housing, double break silver to silver contacts, contact pressure springs retained when movable contact is removed—these—and other features—make this Cam Limit Switch rugged, dependable and full of long time service.*

**THE CLARK CONTROLLER CO.**
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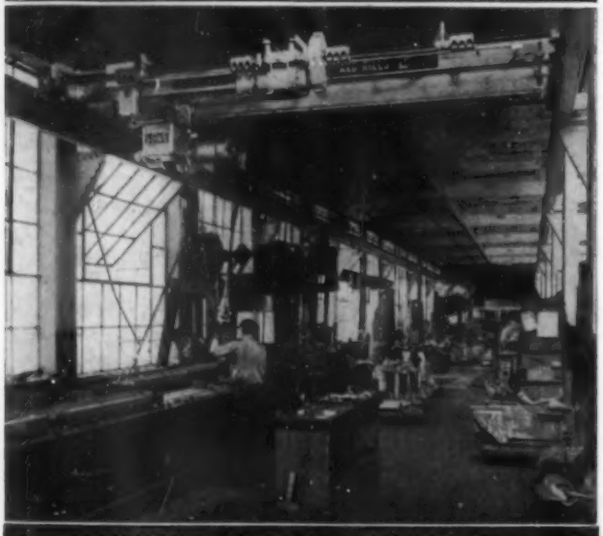
## SINGLE I-BEAM CRANES
SERVE MACHINE TOOLS WITH
PRECISION AND ECONOMY



**SHEPARD NILES**
CRANE & HOIST CORP.
382 SCHUYLER AVENUE, MONTOUR FALLS, N. Y.

Model illustrated develops pressures up to 6,000 lb. per sq. in.

## HIGH PRESSURE PLUNGER PUMP

Capable of pumping various solutions in which solids are held in suspension without appreciable wear. All working parts are designed for heavy duty and long service. Jacketed cylinders permit cooling of volatile liquids or steam-heating of heavy fluids. Vernier calibration of stroke gives full control of flow from zero to maximum. Built to order for any pressure, any capacity. For quotation please furnish us with specific gravity of liquid, pressure and rate of flow.

**WICACO MACHINE CORP.**
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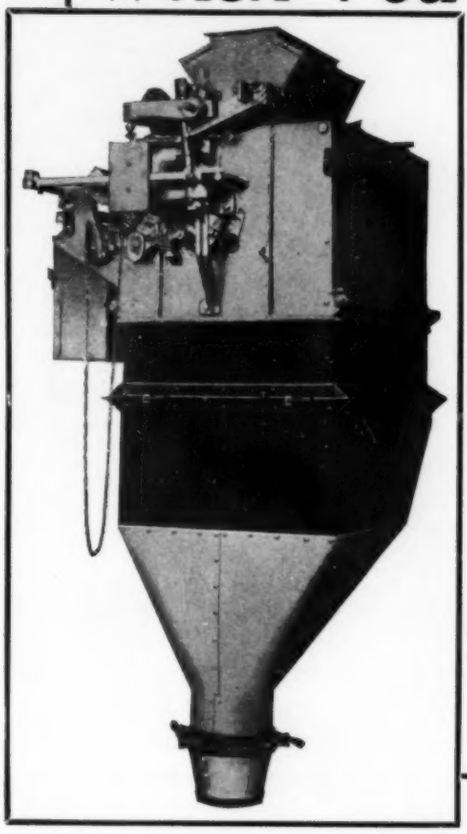
# When You Install RICHARDSON



## AUTOMATIC SACKING SCALES

## Production Goes Up!

## Operating Costs Go Down!

This, in a few words, is the story of high speed precision weighing as offered by RICHARDSON AUTOMATIC SACKING SCALES. They save time and labor, eliminate weight disputes and reduce sacking costs. Write for Catalog 4135-E which explains in detail why and how this is accomplished.

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## BUY TIGHT JOINTS

***For Less . . .*** It's a matter of plain arithmetic that the lowest cost union is the one that gives the lowest cost per tight joint. That's why Darts have the lowest final cost: they make up to tight joints again and again. For Dart bronze seats are not ordinary seats: They're ground with hairline precision to a true ball joint: extra wide spherical surfaces that match all around, *and contact all around* for repeatable, leak-proof seating. Consider too the heavy bodies and nuts of air-refined malleable iron that make Darts proof against wrench abuse and thread distortion . . . We'll put the proof right up to you: send for a Dart to try in your own plant. Write us what size.

**DART UNIONS**

SALES AGENTS: THE FAIRBANKS COMPANY, NEW YORK AND ALL BRANCHES

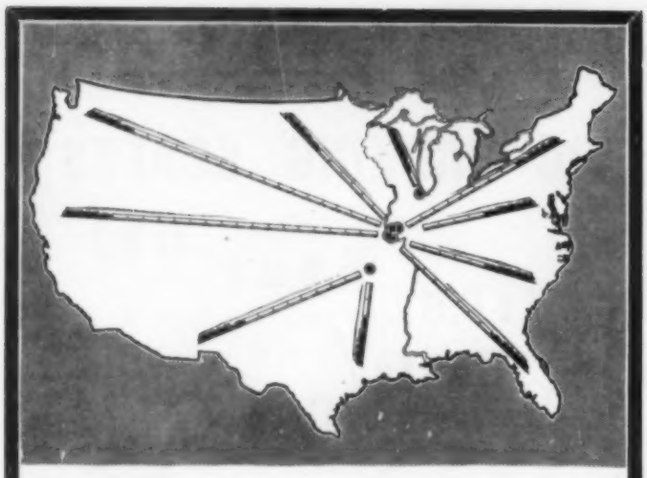
CANADIAN FACTORY: DART UNION COMPANY, LTD., TORONTO, CANADA

E. M. DART MFG. CO., PROVIDENCE, R. I.

## ..Give you definite assurance of uniformity and high quality

An unusually wide and diversified range of steel products makes it possible to meet almost any requirement. Write for the Ryerson Stock List. Joseph T. Ryerson & Son, Inc. Plants at Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

*Immediate Shipment*



# 5 LARGE PLANTS

## ASSURE YOU THE FINEST HIGH-CALCIUM CHEMICAL LIME WHENEVER AND WHEREVER YOU NEED IT—IN ANY QUANTITY!

**MARBLEHEAD CHEMICAL LIME**

Marblehead's extensive facilities offer you your logical source of supply for chemical lime, because . . .

1. Five large plants assure you an adequate supply whatever your requirements.
2. Marblehead's large acreage of high grade, high calcium limestone provides unlimited raw material.
3. Modern equipment produces pure lime of highest chemical activity and uniformity.
4. Marblehead is safe and certain, economical and dependable—maintains fixed proportions—assures uninterrupted production.

Samples, analyses and booklet "Modern Chemical Lime," on request.

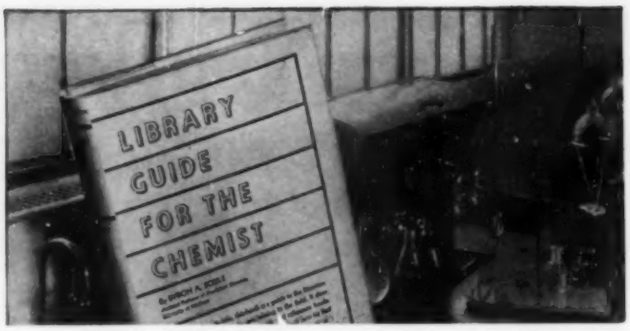
Four Forms

TRY A CAR NOW IN YOUR OWN PLANT

- PULVERIZED QUICKLIME
- *"Chemically Pure"* HYDRATED LIME
- PEBBLE LIME
- LUMP LIME

MARBLEHEAD LIME COMPANY

Chicago, Illinois  Kansas City, Missouri

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By BYRON A. SOULE

*Assistant Professor of Analytic Chemistry, University of Michigan*

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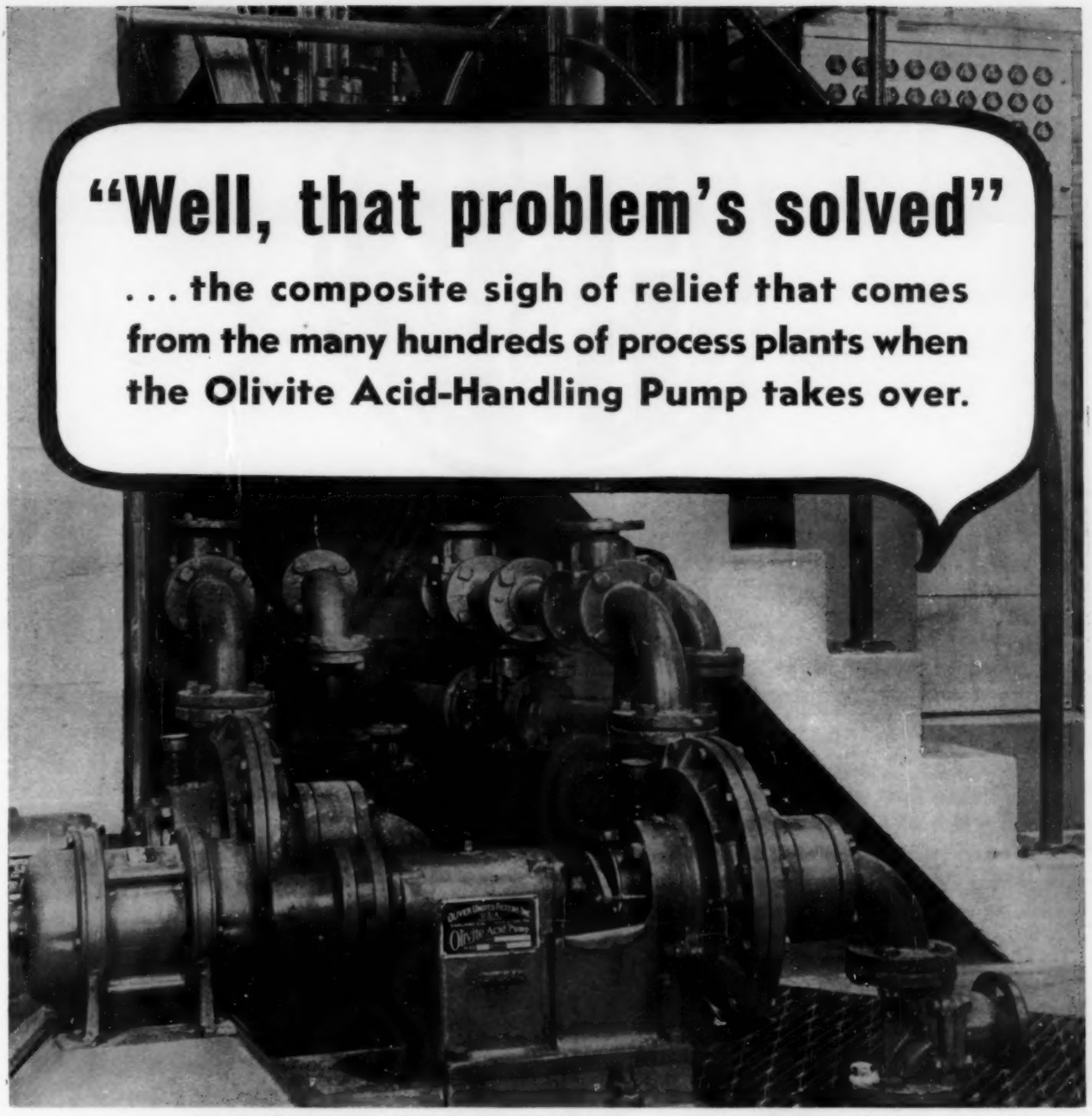
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It's significant—very significant—the number of instances in which process plants have bought trial units of Olivite Pumps and then ordered enough more to take care of the entire job. Even under the best of conditions, handling acids is a tough problem so the switch over to Olivites is a tribute to this pump's efficiency, durability and clean-handling of acids and other hot or cold chemicals.

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*The New*

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| Clay | Plaster of Paris |
| Carbon Black | Quartz |
| Cement | Soda Ash |
| Carbon | Sienna |
| Copper Oxide | Silica |
| Charcoal | Sulphur |
| Dry Colors | Shale |
| Drugs | Slate |
| Dyes | Sugar |
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Kindly send me a copy of the New Gayco Catalog featuring the advantages of Gayco Separators and data on materials that can be handled.

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# CHEM & MET

# *Data Sheets*

## on

# MATERIALS of CONSTRUCTION

FOR the past 16 years our editors have devoted 8 special theme issues to the task of summarizing, correlating and interpreting the advances made in the development and better use of modern materials of construction. In our November, 1938, issue the eighth of this series, they have presented in convenient handbook form, the vital facts and figures most useful in solving practically any corrosion problem to be met in the process industries. Corrosion data from many different sources appears in graphs and tables. Chemical, physical and mechanical properties and essential commercial information has been concisely tabulated and, finally, the whole has been inventoried in a reference index.

This, in truth, is a chemical engineer's handbook of materials, more up to date and comprehensive than any other source, presented in a form that will prove useful in solving the practical problems on which the process industries must depend for their future progress and profits.

*The demand for this material has been such that we have reprinted a limited number of copies of this 34 page section bound in booklet form and now offer them at 50c per copy. You may secure yours by using the coupon below.*

**MAIL THIS COUPON**

CHEMICAL & METALLURGICAL ENGINEERING
330 WEST 42nd STREET, NEW YORK, N. Y.

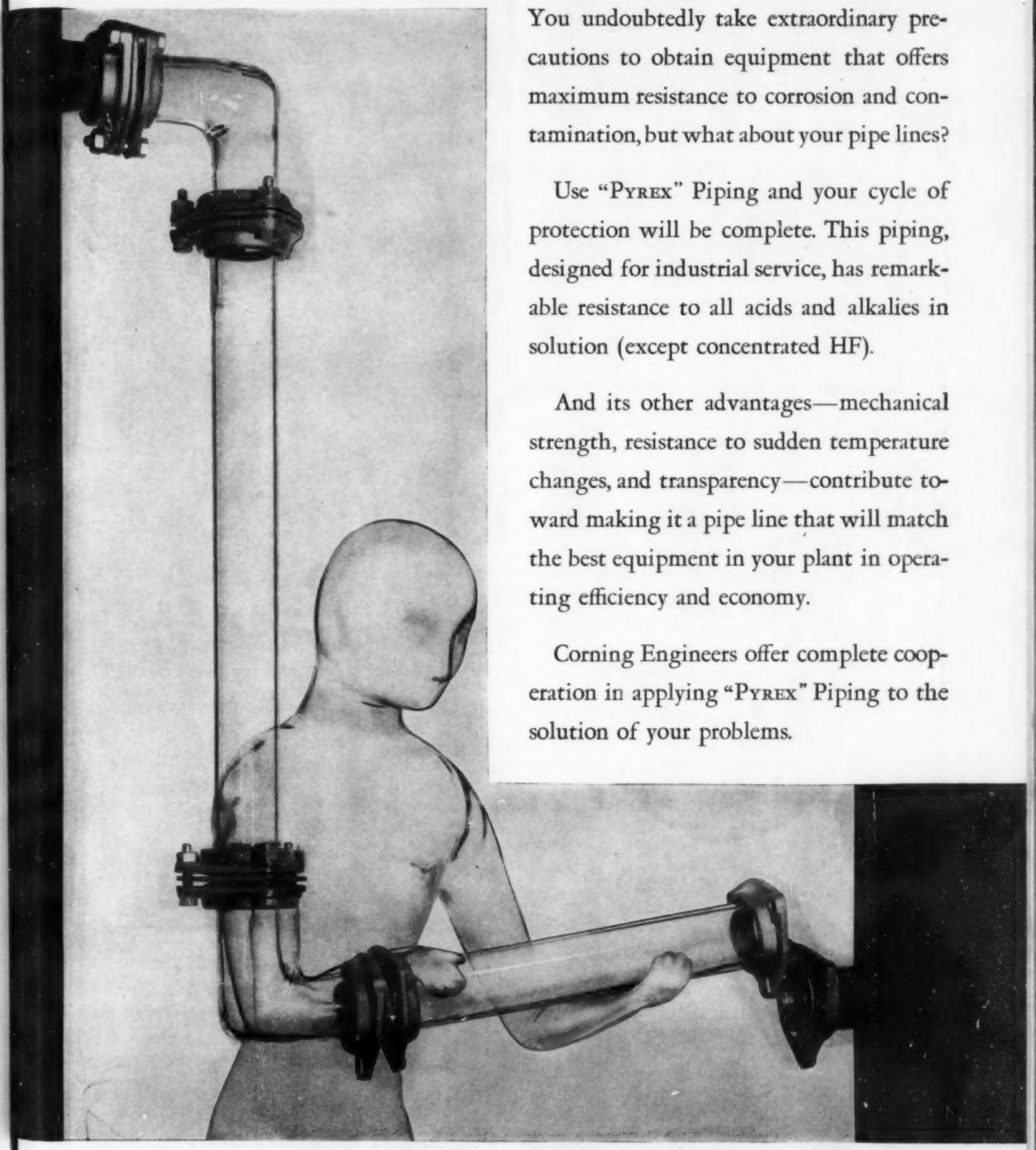
Please send me ..... copies of your Modern Materials Data Sheets DS11 at 50c per copy.

*Name* .....

*Address* .....

*City* ..... *State* .....

# THE *Connecting link* OF PROTECTION



You undoubtedly take extraordinary precautions to obtain equipment that offers maximum resistance to corrosion and contamination, but what about your pipe lines?

Use "PYREX" Piping and your cycle of protection will be complete. This piping, designed for industrial service, has remarkable resistance to all acids and alkalies in solution (except concentrated HF).

And its other advantages—mechanical strength, resistance to sudden temperature changes, and transparency—contribute toward making it a pipe line that will match the best equipment in your plant in operating efficiency and economy.

Corning Engineers offer complete cooperation in applying "PYREX" Piping to the solution of your problems.

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GLASS REVEALS BOTH ITS MAKE-UP AND ITS CONTENTS

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Equipment Materials and Supplies for the Process Industries

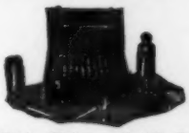
# CHEMICAL & METALLURGICAL ENGINEERING SERVICE SECTION

Equipment Materials and Supplies for the Process Industries

*The* **SERVICE SECTION** *of* **"CHEM. & MET."**

*supplements other advertising in this issue with these additional announcements of products and services essential to modern plant operation. Make a habit of checking this page each issue*

## LaMOTTE CHEMICAL CONTROL SERVICE



**LaMotte Universal pH Outfit**

This compact LaMotte Outfit is readily portable, yet it covers a wide pH range. Can be supplied with any 3, 4, 5, 6 or 7 sets of LaMotte Permanent Color Standards and will therefore cover any desired part of pH range, 0.2-13.6. Applicable to all types of research and industrial pH work. Accurate to 0.1 pH. Excellent for use with highly colored or turbid solutions.

Price $35.00 to $55.00 f. o. b. Baltimore, Md.

**LaMOTTE CHEMICAL PRODUCTS CO.**

*Originators of Practical Application of pH Control*

444 Light St. Baltimore, Md.

## NO TWO SIDES ALIKE

This **ALUMINUM HOPPER** made of ⅛" plate, filling a space 8' square, has no two sides alike because the manufacturer's requirements necessitated our fabricating this most unusual design. We invite your inquiries concerning the fabrication of any special equipment you may need in Your production.

A.S.M.E. code welding in **Aluminum, Chrome Nickel Alloys, Silicon Bronze and Steel.**

**CAMDEN COPPER WORKS, INC.**
CAMDEN, NEW JERSEY

## WYCKOFF REDWOOD PIPE

Clear California Redwood pipe has greater carrying capacity than metal or concrete pipe. Does not clog, scale or pit. Light weight. Easily installed. Not affected by electrolysis, worms, frost and resists heat. Use it for sewage, liquors, acids, water, heavy fluids containing grit — for flumes, fume ducts, etc. Sizes 1" and up. Pressures at 172 lbs. We also manufacture Redwood Underground Steam Pipe Castings. Lengths up to 12 ft.

**A. WYCKOFF & SON CO.**
OFFICE&FACTORY—12 HOME ST., ELMIRA, N.Y.
*Originators of Machine Made Wood Pipe*
1855—*Our Eighty-Third Anniversary*—1938

## ZIRCON

For the FIREBRICK REFRACTORIES and CERAMIC INDUSTRIES

*High Standard Quality of any Tonnage*

**ZIRCON RUTILE LIMITED**
374 Little Collins Street,
MELBOURNE, AUSTRALIA

Charles Hardy, Inc., 415 Lexington Ave., New York City, Agents.

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must be received by January 6th to appear in the January issue.

*Address copy to the Departmental Advertising Staff*
**Chemical and Metallurgical Engineering**
330 West 42nd St., New York City

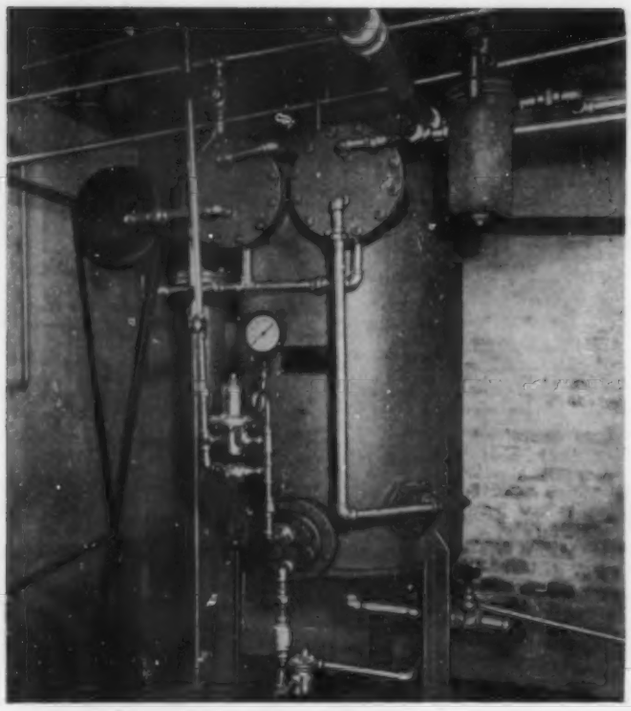
## THE PURE OIL COMPANY

PURE THREE POINT LUBRICATION

THREE POINT SERVICE — PURE CRUDE — INDUSTRIAL DEPT. APPLICATION ENGINEERING

A COMPLETE LINE OF INDUSTRIAL PETROLEUM PRODUCTS

**OIL CO.**
CHICAGO, U.S.A.



**WHITLOCK STILLS have many practical "dollars and cents" advantages:**

1. Deliver a clear, pure solvent.
2. Reduce total solvent investment as practically no solvent is lost during purification—or yield more solvent.
3. Still is simple to operate and does not require frequent servicing.
4. Differential duty, twin condensing units are highly efficient, reducing steam consumption as solvent is pre-heated, and requiring much less cooling water.
5. All parts are easily accessible for necessary cleaning or inspection.

"TECHNICALLY SPEAKING"

Whitlock Stills are made of shell materials suitable for use—steel, Everdur, copper, or alloys. U-Tube heating element can also be made of any material available in tubing.

Explain conditions of use completely when writing for more details. Address—

**THE WHITLOCK COIL PIPE COMPANY**

94 South Street, Elmwood, Hartford, Conn.

*Consult the telephone directory for local address in*

New York, Boston, Philadelphia, Chicago, Detroit, Kansas City, Baltimore, Richmond, Los Angeles, San Francisco, Cincinnati and other principal cities

In Canada address Darling Bros., 120 Prince St., Montreal

**WHITLOCK HEAT EXCHANGERS**

**MONARCH HARD RUBBER SPRAY NOZZLES**

Patented Fig. B-27 illustrated produces a fine, evenly distributed hollow cone spray. "Non-clogging" as it contains no internal slots or vanes—simply a single large tangential inlet. Relatively simple construction makes this nozzle least expensive hard rubber type.

Capacities from 4.2 to 720 g.p.h. at 10#.

Other types available in capacities to 34.5 g.p.m. at 10#.

**STONEWARE SPRAYS**

Monarch stoneware nozzles have replaced other sprays in most plants throughout the world. Will not break or crack from temperature changes. Hard lead body and cap.

Write for Catalog 6-C

**MONARCH MFG. WORKS, INC.**

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*Important**

**TO PLANT ENGINEER**

***SOLVE YOUR PUMP WORRIES THIS WAY**

Install Taber standard centrifugal "wide application" pumps in your process system and eliminate the costly one-service handicaps of single-purpose pumps.

Taber's "CL" and "CV" series pumps have been engineered to give steady, reliable, general-purpose performance. Deep stuffing boxes, external ball bearing shaft support and bronze impellers are features contributing to outstanding Taber pump operation. Only standard motors used. Capacities, 25 to 600 gpm., 1¼" to 4" standard pipe size discharge connection.

"Production" manufacturing of these "wide application" pumps makes for a reasonable initial cost—a definite attraction to plant engineers seeking truly economical centrifugal pumps for trouble-free all-purpose work in most any process system. Illustrated Bulletin LV-238 containing rating tables and description of this pump mailed promptly upon request. 8366

TABER PUMP CO., 294 Elm St., Buffalo, N.Y. (Est. 1859)

**SAVE ON PUMPS . . . WITH TABER ECONOMY**

# STAINLESS STEEL

## CASTINGS • FITTINGS • VALVES

*Stainless Steel Polished Propellers (sanitary castings) for dairy and beverage industry.*

**CORROSION • HEAT • ABRASION-RESISTING**

All wanted alloys. ANY weight or pattern up to 2 tons. Special machining when wanted. IMMEDIATE service guaranteed. Ask for details, prices.

**THE COOPER ALLOY FOUNDRY CO.**
ELIZABETH, NEW JERSEY

**COOPER** STAINLESS STEEL CASTINGS

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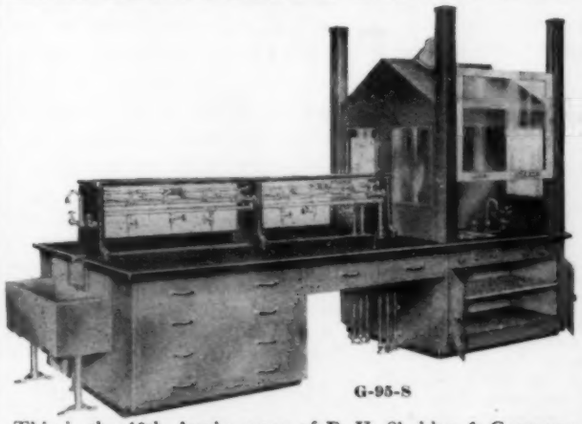
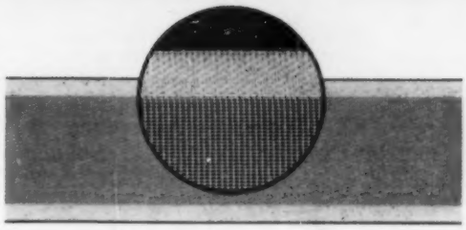


G-95-8

This is the 40th Anniversary of E. H. Sheldon & Company as a manufacturer of Laboratory Furniture for Industries, Hospitals and Colleges. The past five years have seen revolutionary developments brought about by laboratory discoveries. We have endeavored to keep in step with scientific progress by an intensive period of development designed to increase the efficiency of our furniture. This applies to many new service connections, chemical resisting materials, new methods of ventilating, and the incorporation of safety features necessitated by up to date laboratory practice. Our catalog will be of value to those equipping laboratories. Write for the Industrial Edition today.

**E. H. SHELDON & CO.**
736 Nims St., MUSKEGON, MICHIGAN

# Jelliff
## WIRE CLOTH
*Since 1880*



# ROLLED SELVEDGE EDGE

ENGINEERING accuracy in Wire Cloth has been made possible by a new patented "rolled selvedge." It can be produced and assembled with mechanical precision. It is calendered to uniform thickness and is mechanically accurate. Ravelled edges, broken and loose strands, uneven mesh is eliminated by this new process. It maintains its strength, rigidity and shape under stress, and is of particular value to manufacturers of products requiring accuracy of assembly and large production. It reduces waste, spoilage and insures maximum economy in labor and material. JELLIFF Wire Cloth can be furnished in any sizes to meet any requirements. Selvedge from 6 to 250 mesh, in widths from ½" to 8" wide, with selvedge edges from 3/64" to ⅜" wide.

WIRE PRODUCTS Jelliff SINCE - 1880

*"Wire cloth for every purpose"*

**The C. O. JELLIFF MFG. CORP.**
SOUTHPORT, CONN.

Representatives in
New York - Chicago - Buffalo - Boston - Newark - Atlanta
Houston - Detroit - Dayton - Seattle - Oakland - Los Angeles

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10 cents a word, minimum charge $2.00
*Positions Wanted* (full or part-time salaried employment only), 5 cents a word, minimum $1 an insertion, payable in advance.
*(See ¶ on Box Numbers)*
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**INFORMATION:**
*Box Numbers* in care of our New York, Chicago and San Francisco offices count 10 words additional in undisplayed ads.
*Discount* of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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1 inch ..... $6.00
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*An advertising inch* is measured vertically on one column, 3 columns—30 inches—to a page. *Contract rates on request.*
C.&M.

COPY FOR NEW ADVERTISEMENTS RECEIVED UNTIL 10 A. M. THE 7TH OF THE MONTH FOR THE ISSUE OUT THE SAME MONTH

### EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 29 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 260 Delward Bldg., Buffalo, N. Y.

### POSITIONS WANTED

*(See also "Selling Opportunities Wanted")*

HIGH CLASS GLUE MAN, thoroughly familiar with all phases of hide and bone glue manufacture, grading, testing and uses of all glues, 22 years' experience is ready to consider new connection. PW-766, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

CHEMIST M.I.T. Recent graduate, some laboratory and plant experience, any location. Research development, particular interest dyes. Box 133, West New York, New Jersey.

CHEMICAL EXECUTIVE, Professional Engineer, fifteen years diversified experience in sales development, technical service and advertising; field research, management, operation; patent licensing, litigation and contracts. Widely traveled; three foreign languages; patents and publications. Presently employed in executive capacity but desires change early 1939 as Technical Assistant or Administrative Officer. PW-771, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

ORGANIC CHEMIST. PH.D. Jewish immigrant from Germany. Age 40. Married. Salary secondary to opportunity. PW-772, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

LABORATORY ASSISTANT, 1938 high school graduate desires position with progressive firm, preferably in research. Excellent scholastic record and references. Interested in opportunity for the inception of life work and for advancement. Studies for chemical engineering begun by correspondence. Salary and location secondary. Ambitious. Available immediately. PW-774, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

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Selling Agencies—Sales Executives
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### OPPORTUNITY OFFERED

DISTRIBUTORS WANTED for the new Stevens Metal Spray Gun. Must be able to finance the purchase and sale of these guns. Apply by letter giving sales experience and credit references, to Homogeneous Equipment Company, Downingtown, Penna.

### OPPORTUNITY WANTED

A PROCESS EQUIPMENT SALES MANAGER available with a background of eighteen years in design, construction, and erection of Chemical Process Equipment. I am very much interested in a selling connection with a well-known manufacturer of pumps, valves (high pressure), or similar equipment where my wealth of experience can be translated into more sales for my employer and consequently a bigger increase for myself. Will gladly supply detailed information and references on request. SA-773, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

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For sale, back copies of such as Chemical and Metallurgical Engineering, Chemistry and Industry, Journal Chemical Society, Industrial Engineering, Chemistry. B. Login & Son, Inc., 29 East 21st St., New York.

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ANYTHING within reason that is wanted in the field served by Chem. & Met. can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

**PLATINUM SCRAP**
**MERCURY**
in any form
We pay highest market price, make prompt returns and hold goods for your approval.
Smelters **I. MILLER, INC.** Refinery
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**WANTED**
**Good used 3'x6' rod mill granulator for foundry slags.** Quote price, description, make, etc., to
**SONKEN-GALAMBA CORPORATION**
**64 N. 2nd St. Kansas City, Kansas**

**WANTED**
**By-Products—Surplus—Residues**
**Waxes • Solvents • Dyestuffs • Oils • Resins**
**Greases • Intermediates • Starches, etc.**
**( Job lots of standard materials always available Cut Cost—Write for our price list )**
**CHEMICAL SERVICE CORP.**
**237 Fourth Ave. New York City, N. Y.**

FOR SALE
**Filler—Bagging Machine**
Six compartment Type "S" **Dracco Filter** with 2700 square feet wool bag filter area, automatic shake-out, extra large storage hopper, automatic thermostat control on air inlet, damper, complete with necessary steel supports, blower and motor rated at 10,000 c.f.m. together with **Howes "Invincible"** Bagging Machine.
Used only a few months for zinc oxide. Priced for prompt sale. May be seen at **DETROIT ELECTRIC FURNACE COMPANY, 825 West Elizabeth Street, Detroit, Michigan** or inquire, **DRACCO CORPORATION, Cleveland, Ohio.**

**FOR SALE**
14 Units each consisting of 12-One Gallon Jars **Paul O. Abbe Pebble Mills,** with ¾ HP 220 V Motors. One **Bryant Silica Gel Air Conditioning Unit** for 5760 C.F. **Phosphoric Acid, Aluminum Phosphate, Fluoride, Hydrate, Fluorspar, Feldspar, Cryolite,** all orig. pkgs, 1-2 ton lots.
**BAKER & CO., INC.**
**113 Astor Street, Newark, N. J.**

*These Advertisements*

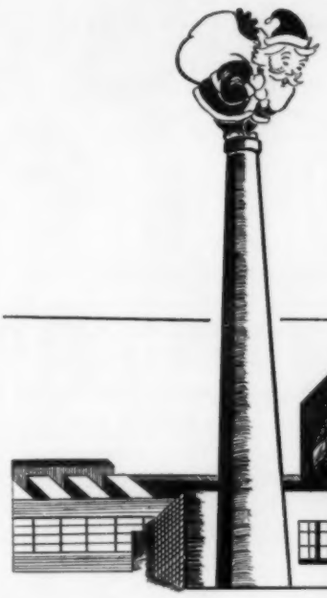
constitute a comprehensive group of "live" opportunities in the industry served by this paper.

Each announcement represents a current Want of a concern or individual in the industry with some element of profit in each for whoever can fulfill the need. Some have money-saving possibilities, others are opportunities for more business; many are employment opportunities while still others offer chances to buy going businesses, plants, property, etc.

"Searchlight" advertisements are constantly changing. New opportunities find their way into this great Want medium each issue. Regular consultation of the "Searchlight" pages should be as important to the careful reader as reading editorial articles of his particular liking. One is news of the industry, the other, the NEWS OF OPPORTUNITIES being offered in the industry.

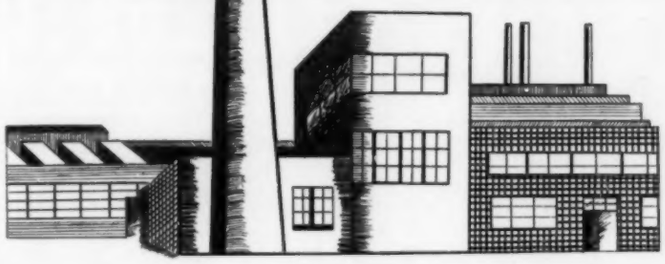
For Every Business Want

"Think SEARCHLIGHT First"



# Don't Wait For Santa Claus!

**—to improve Your business! If you want smooth sledding for the New Year chop costs and increase profits with Consolidated's Guaranteed Good Rebuilt Equipment. . .**



**Selected Items**

1—Devine 5′ x 30′ Rotary Vacuum Dryer
2—Tolhurst 40″ Rubber Lined Centrifugal Extractors
2—24″ Mikro Pulverizers, belt driven
1—Devine 52″ x 126″ Rotary Vacuum Drum Dryer

## *Priced Low For Quick Action.*

2—40″ Cresson-Morris bronze basket Centrifugal Extractors, motor driven, complete with mixers.
12—Distillation Units, 72″, 60″, 54″, 48″, 36″, 30″, 24″, 14″, complete with dephlegmators, condensers and still pots.
8—Sweetland Filters, Nos. 12, 11, 10, 9, 7, 5, 2, and laboratory sizes—copper, iron and monel leaves.
14—Oliver Filters, 3x2 ft. 6x4, 6x6, 6x8, 8x9, 8x12.
28—Filter Presses, 12″ to 42″, plate-frame and recessed.
10—Devine Vacuum Shelf Dryers, No. 6, No. 5, No. 1, No. 12, No. 23, No. 26, No. 27, No. 30.
1—Atmospheric Drum Dryer, 4′x8′; 1—3′x 5′ 6″ Double Drum.
1—Kilby 7′ Calendria Vacuum Pan.
7—Copper Jacketed Vacuum Pans; 1—Lummus, 500 gal.; 6—50 gal. to 500 gal.
10—Rotary Dryers, direct heat, 3x20, 4x20, 5x26, 5x30, 6x60, 8x60.
1—Patterson 6′x8′ Silex Lined Pebble Mill.
2—Glass lined Jacketed Agitated Kettles, 250 gal. each.
2—Autoclaves—150 gal. full, Jacketed, Agitated; 1—600 gal. Jacketed, Agitated.
1—J. P. Devine, 5′ x 30′ Rotary Vacuum Dryer, complete; 2 Devine 4′x30′.
2—Devine 3′x25′ Rotary Vacuum Dryers.
3—Anderson Oil Expellers, No. 1.
4—W. & P. size 30, type X, Jacketed Mixers, 2650 gal.
1—Broughton No. 1500 Dry Mixer, double shaft.
7—Rotex Sifters, 20″x48″, single deck, motor driven.
1—Zaremba Quadruple Effect Evaporator, 3000 sq. ft. per effect.
9—Aluminum Storage Tanks, 7—550 gal., 2—250 gals.
10—Vibrating Screens—3′x6′, 2—Deck Niagara; 3′x5′, 4′x5′ Tyler Hummers; 4x8 Rotex.
8 Raymond Pulverizers No. 0000 to No. 3; three and five roll high side roller mills.
1—Hendy 3′x12′, continuous Tube or Rod Mill.
8—Hardinge Conical Mills, 3′x8″, 4½′x16″, 6x22, 7x36, 8x30.
2—G.E. Co. 800 H.P. Synchronous Motors, 3 ph. 60 cy. 2300 V., 900 RPM.
2—100 ton York Refrigerating Units, vertical type, each directly connected to 150 H.P. synchronous motors, 3/60/440 volt.
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1—Duriron 750 gallon Jacketed Kettle.

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12" Sperry Stainless Steel Filter Press.
42" Pfaudler Glass Lined Vacuum Pan.
200 gal. Stainless Steel Tank, jacketed & agitated.
4—1500 gal. Stainless Steel Truck Tanks.
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200 and 500 gal. Pfaudler Tanks, jacketed, agitated.
18" Shriver Iron Filter Press, 12 chambers.
12" and 18" Shriver Filter Presses, recessed.
300 gal. Pfaudler Pre-Vak Percolator.
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170 and 500 gal. Copper Jacketed Kettles.
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2 to 7 ft. Copper Vacuum Pans.

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1—75 gal. Glass Lined Jack. Still.
1—Burkhard 200 gal. Jack. Copper Vac. Still.
1—2000 gal. Pfaudler Glass Lined Jack. Vac. Still.
2—Buffalo Vac. Pumps, motor driven.
13—Pfaudler Glass Lined Open Tanks & Jack. Kettles, 25 to 200 gals.
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1—Williams "Regular" Type Ball Bearing Hammer Mill, Pulley Driven.
1—Hardinge Conical Mill, 6'x36".
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6—Direct heat Dryers—3x30 to 5x40'.
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1—28" Schutz-O'Neill Pulverizer, ball bear.
2—Sweetland Filters—#10 and #5.
1—Kelly #100 Filter.
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4—Day Jumbo Double Spiral Mixers, 2'x3'x4'
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15—10 to 100 Gal. Pebble Mills
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30—50 to 500 Gal. Copper Jacketed Kettles
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## the small FAN
*that does a*
## BIG JOB!

● Drying, exhausting, cooling, heat distribution, wherever you require a small fan to render an important air handling service, we suggest that you check the advantages and economies offered in our line of Buffalo Baby Conoidal Fans.

Fans are supplied complete with motors, and fan housings may be easily and quickly adjusted to any position of discharge.

Prompt shipments from stock on all standard sizes. Write for new Bulletin 475-E.

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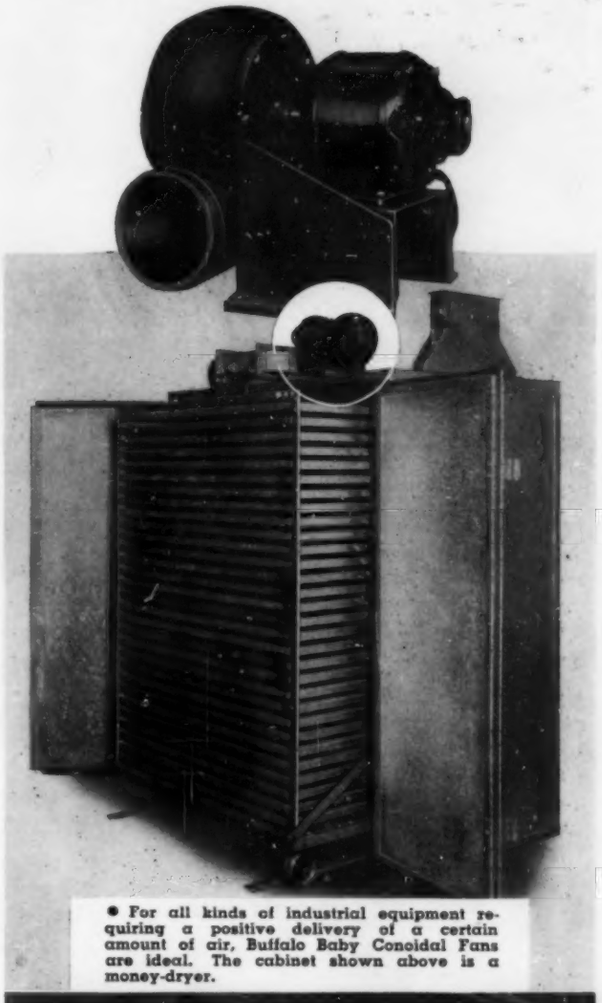
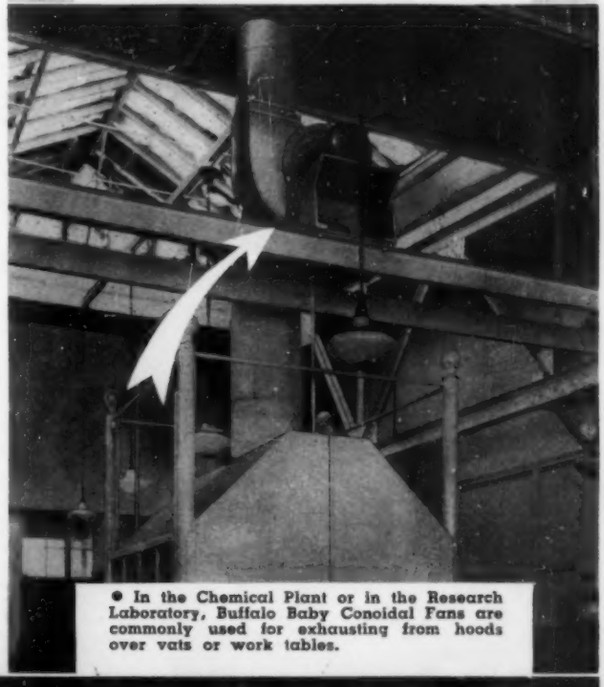


● For all kinds of industrial equipment requiring a positive delivery of a certain amount of air, Buffalo Baby Conoidal Fans are ideal. The cabinet shown above is a money-dryer.



● In the Chemical Plant or in the Research Laboratory, Buffalo Baby Conoidal Fans are commonly used for exhausting from hoods over vats or work tables.

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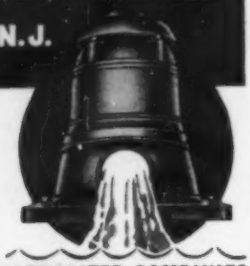
# 27 Layne Well Units
## FOR THE CITY OF CAMDEN, N.J.



**Definitely knowing that their one-hundred small driven Morris Station wells were costly to operate, inefficient, and inadequate for either present or future needs, the City of Camden, N. J., placed their water problem before the Layne New York Company. In 1922 a contract for 6,000,000 gallons daily (four wells) was awarded. Highly satisfied with the splendid efficiency and low operating cost of the first four wells City Authorities contracted for 10,000,000 gallons more per day. Five more Layne Well Units were installed. In 1925 nine of the Morris Station wells were Layne Gravel Wall equipped, adding another 17,000,000 gallons per day.**

**In all, Camden now has twenty-seven Layne Unit Wells with a capacity of 45,000,000 gallons per day. High efficiency due to Layne Pumps and Well Engineering features, gives Camden water at a cost of 1.5c per 1,000 gallons. $200,000.00 a year from the Water Division's net profit are annually returned to the City's general fund.**

**Such problems as faced Camden may be similar to your case. More details of how Layne Well Units give more water —at lower cost, will be sent gratis. Address LAYNE & BOWLER, INC., DEPT. T-3, MEMPHIS, TENN.**

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*For Municipalities, Industries, Railroads, Mines and Irrigation*


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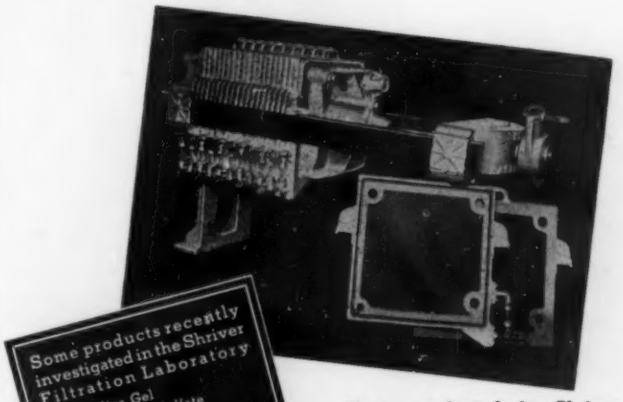
**It is the business of the Shriver Laboratory to help determine the filtration characteristics of your material: to determine its chemical and physical nature, rate of flow under varying conditions of temperature or pressure, method of delivery of filtrate and recovery of solids.—The recommendations of this laboratory are scientific, practical, unbiased.**

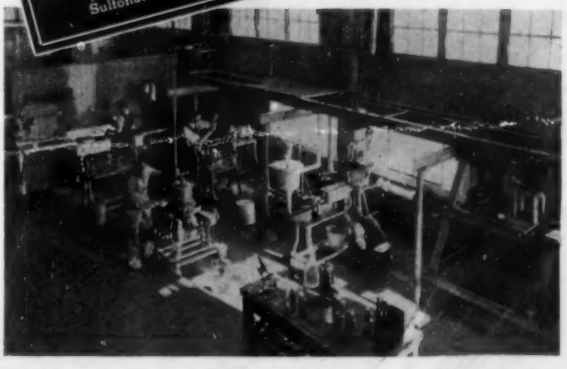
**It is the business of our engineering and manufacturing departments to specify and build filter presses of such material and design as will best meet your particular requirements.**

**Thousands of Shriver Filter Presses in satisfactory service today are the best indication of reliability of their performance based on careful study of the job they had to do.**

**Put your filtration problem up to us.**




**Tests conducted in Shriver Laboratory (below) dictated the design of this bronze plate and frame, washing type, leakproof filter press, equipped for visible discharge.**



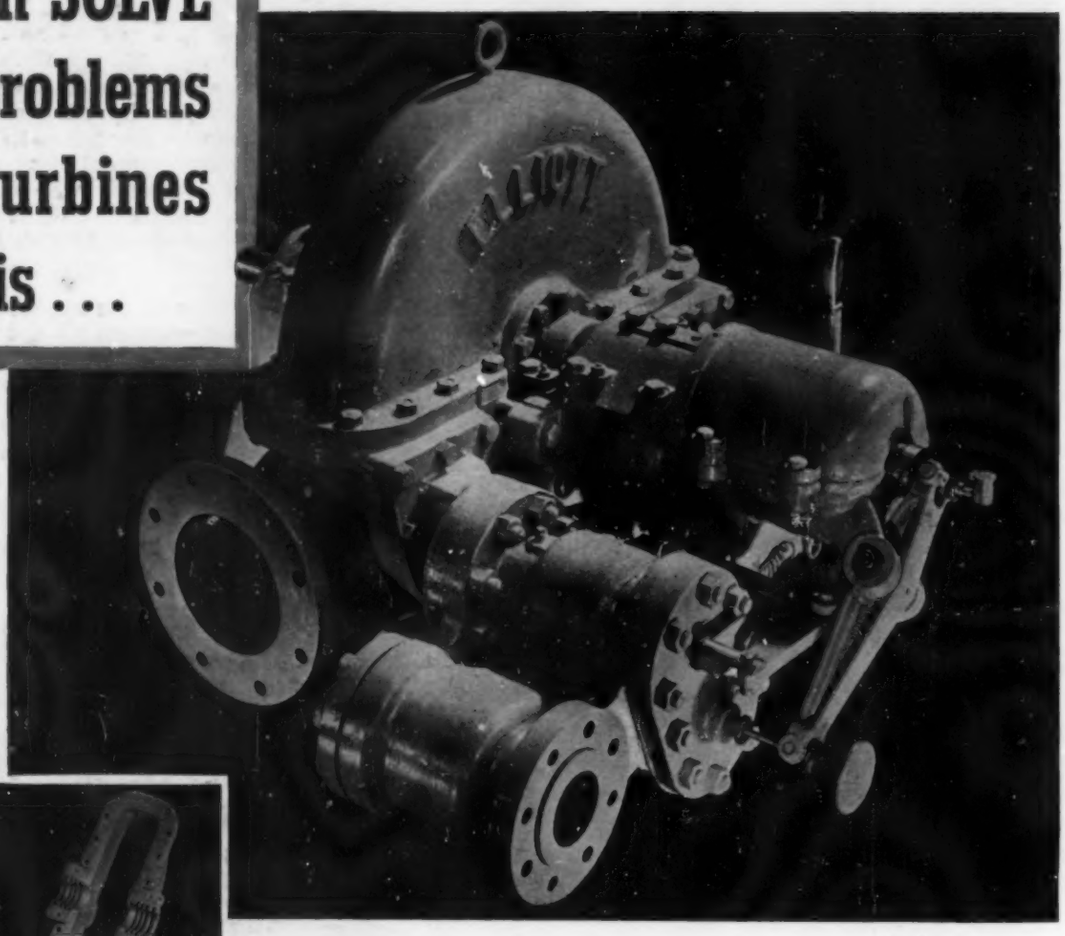
**SHRIVER FILTER PRESSES**

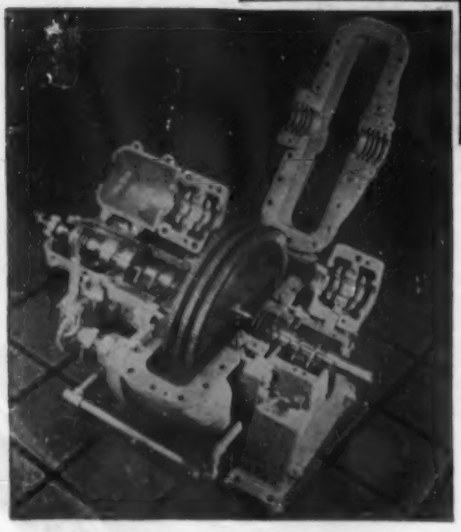
**T. SHRIVER & COMPANY**

**802 Hamilton St. Harrison, N. J.**

*Western Agents: THE MERRILL CO.*
*343 Sansome St., San Francisco, Calif.*

# You can SOLVE drive problems with turbines like this . . .





## ELLIOTT TURBINES

for mechanical drive, just breathe sturdiness in every line. Note the husky construction; two oil rings on each bearing, large water-cooled oil reservoir, removable basket steam strainer, and separate emergency valve. These are only a few of the most obvious points. These turbines are built to "take it" and to give service under toughest conditions.

H-622a

The pictures show the Type CY Elliott Turbine, newest addition to the line of Elliott mechanical drive turbines, extending upward the size range of the popular Elliott "Y" line of mechanical drive units.

This line of turbines is popular because it has the stuff. There are any number of design and construction features which appeal strongly to turbine operators and make a swell performing machine. The CY turbine has even more of these desirable features.

As one enthusiastic operator wrote us the other day "I want to say that you have not scratched the surface in your praise of these turbines. An operator must put the utmost confidence in his draft fans, especially on pulverized fuel. The Elliott turbines never give us any trouble and perform their job with all-around satisfaction. Maintenance on these turbines has been less than on any other turbines in the plant."

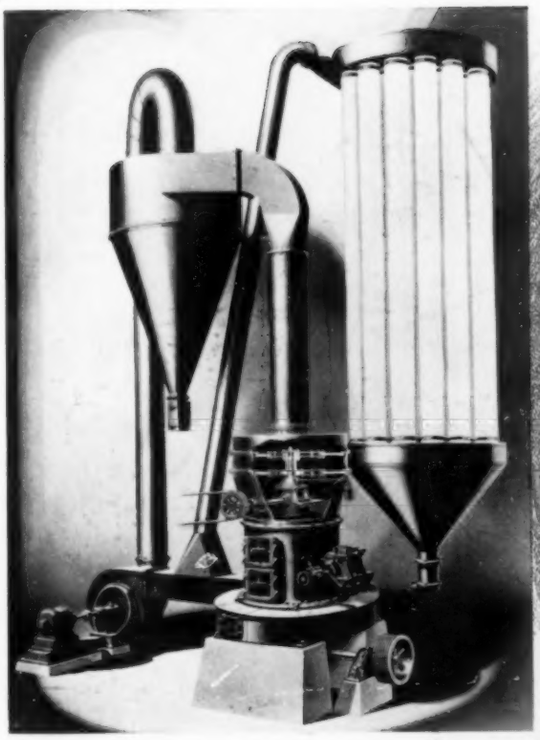
You can now get a Y-line turbine for practically any power requirement, steam pressure, or temperature condition. Elliott geared units are available for low-speed drives.

● *You will like these Elliott turbines all the more when you examine them for construction details, point for point. We suggest writing for Bulletin H-11.*

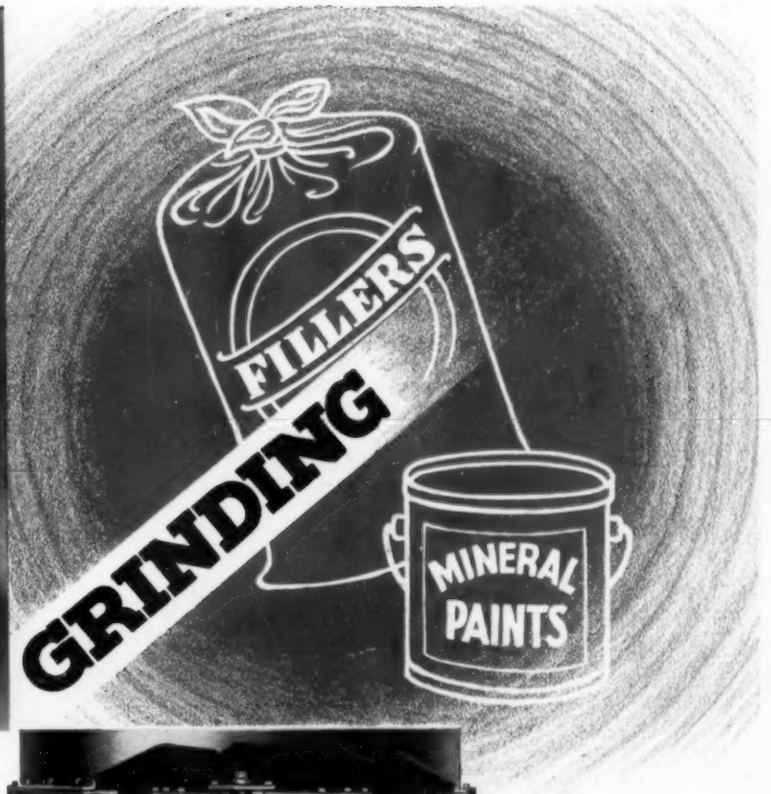
## ELLIOTT COMPANY

**Steam Turbine Dept., JEANNETTE, PA.**

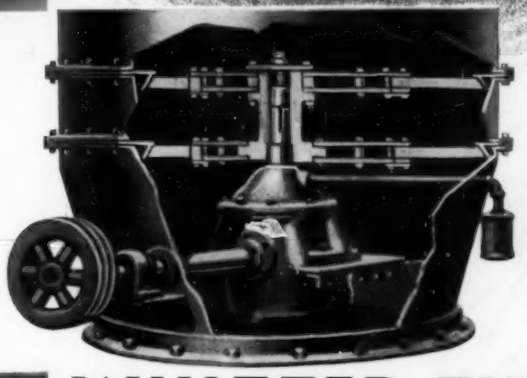
*District Offices in Principal Cities*



The famous Raymond Roller Mill *plus* the patented Whizzer Separator *equals* the modern Pigment Grinding Mill




PIGMENT



Detail of revolving whizzer, driven through variable speed transmission which gives wide range fineness control by changing the speed of the whizzer. Built in single type whizzer for standard classification, and in the double type for extreme fineness.

**AT NEW LOW COSTS**

# WHIZZER TYPE MILL

Manufacturers of paint pigments and fillers are able to increase the marketability of their products, and obtain a wider margin of profit, by the use of the Raymond Pigment Grinding Mill. This modern machine produces an extremely fine and uniform powder, testing 99.99% passing 325-mesh.

It has a wide range of uses like the standard Raymond Roller Mill, but is especially adapted for pulverizing mineral paint materials including white lead, lithopone and titanium pigments — also for extremely fine ground fillers such as limestone, natural and synthetic chalks, barytes and clays.

The patented whizzer separator on this mill gives close control over the fineness of the product and yields greatly increased output. On harder materials, this unit delivers 25% to 50% higher tonnages than former types of equipment, and on softer materials the increase is as high as 100 per cent. Production costs are also reduced, and large savings are reported by users of the Raymond Pigment Grinding Mill.

*Write for specifications and applications of the Raymond Pigment Grinding Mill*

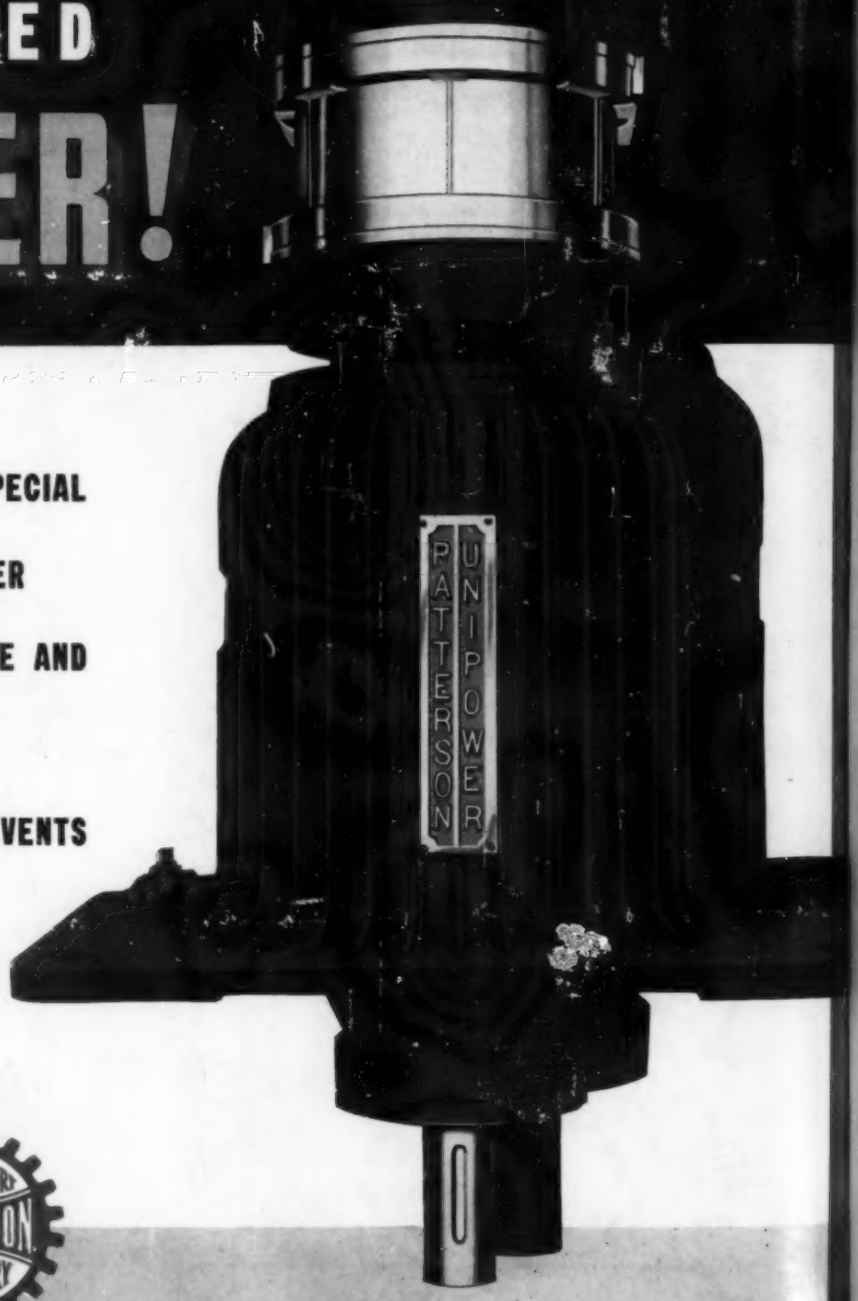
**RAYMOND PULVERIZER DIVISION**
COMBUSTION ENGINEERING COMPANY, INC.
1311 North Branch Street CHICAGO

# Patterson Introduces—

## THE *New* STREAMLINED

# UNIPOWER!

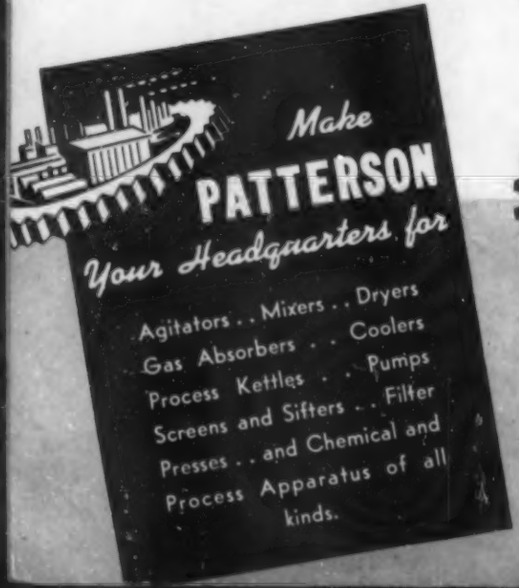
(PATENTED)




*Featuring*

1. HELICAL STEEL GEARS CUT TO NEW SPECIAL PRESSURE ANGLE
2. QUIET, SMOOTH, VIBRATIONLESS POWER
3. COMBINATION ANTI-FRICTION GUIDE AND THRUST BEARING
4. DOUBLE PLUNGER PUMP LUBRICATION
5. INDEPENDENT OIL RESERVOIR PREVENTS LEAKAGE
6. STREAMLINED BEAUTY

Richard L. Cameron
President


Make
PATTERSON
Your Headquarters for
Agitators . . Mixers . . Dryers
Gas Absorbers . . Coolers
Process Kettles . . . Pumps
Screens and Sifters . . Filter
Presses . . and Chemical and
Process Apparatus of all
kinds.

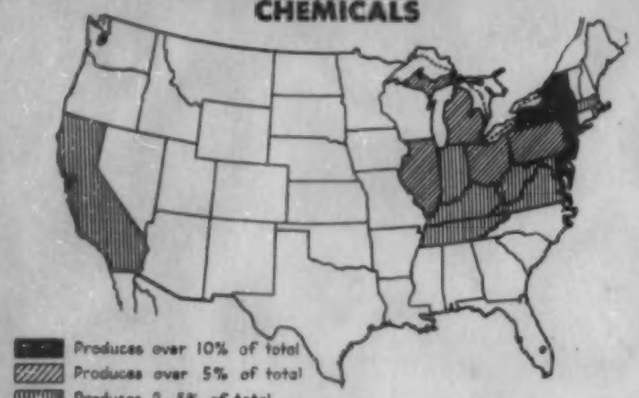
SATISFACTORY PATTERSON MACHINERY

**THE PATTERSON FOUNDRY & MACHINE CO.**

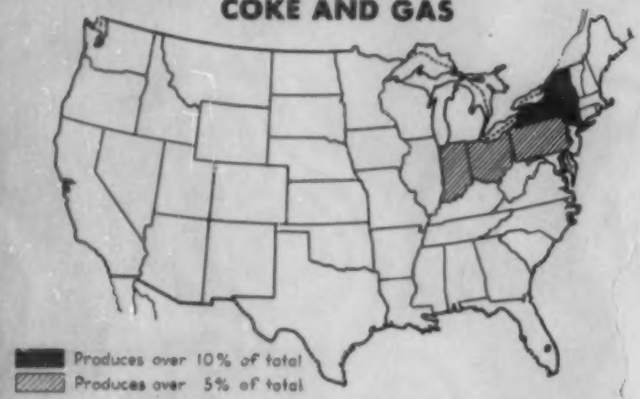
EAST LIVERPOOL,

OHIO, U.S.A.

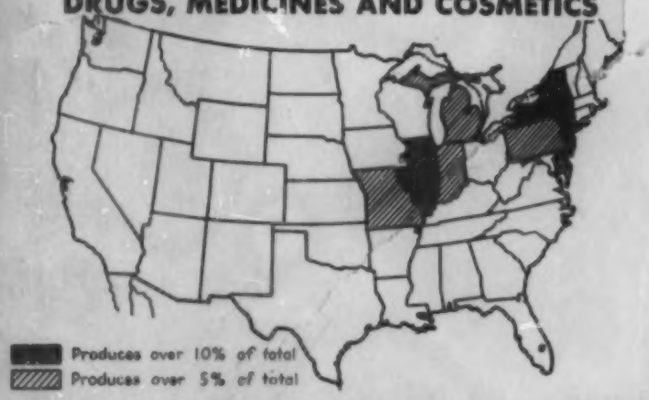
## CHEMICALS



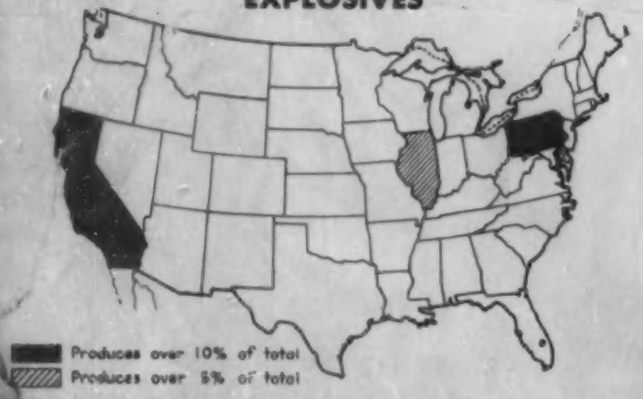

## COKE AND GAS




## DRUGS, MEDICINES AND COSMETICS




## EXPLOSIVES




## GLASS AND CERAMICS

*(All values expressed in thousands of dollars)*

## 1 • NEW YORK CITY INDUSTRIAL AREA

Comprising Greater New York and Westchester County in New York and Bergen, Essex, Hudson, Middlesex, Passaic, and Union Counties in New Jersey.

| Industry | No. of estab. | [1]No. of workers | [1,3]Cost of materials | [1]Value of products |
|---|---|---|---|---|
| Baking powder, yeast and other leavening compounds | 11 | 799 | 4,032 | 9,981 |
| Blacking, stains, and dressings | 23 | 327 | 2,554 | 5,745 |
| Candles | 9 | 290 | 851 | 1,619 |
| Chemicals not elsewhere classified | 116 | 10,198 | 50,078 | 94,125 |
| Cleaning and polishing preparations | 71 | 606 | 2,824 | 7,028 |
| Compressed and liquefied gases | 13 | 311 | 772 | 3,038 |
| Drugs and medicines | 105 | 4,030 | 14,807 | 58,076 |
| Fertilizers | 10 | 511 | 2,203 | 3,213 |
| Fireworks and allied products | 5 | 211 | 237 | 676 |
| Glue and gelatine | 10 | 203 | 1,502 | 2,541 |
| Grease and tallow, not incl. lubr. greases | 22 | 754 | 9,909 | 12,933 |
| Ink, printing | 58 | 923 | 7,018 | 13,677 |
| Insecticides and fungicides and industrial and household chemical compounds n.e.c. | 103 | 758 | 5,826 | 12,927 |
| Mucilage, paste, and other adhesives, except glue and rubber cement | 19 | 79 | 333 | 807 |
| Oils, essential | 6 | 109 | 1,076 | 1,377 |
| Paints, pigments, and varnishes | 247 | 6,793 | 50,830 | 102,806 |
| Perfumes, cosmetics and toilet preparations | 210 | 4,573 | 22,599 | 62,860 |
| Soap | 39 | 3 295 | 33,230 | 58,067 |
| Tanning materials, natural dyestuffs, mordants and assistants, and sizes | 38 | 615 | 7,771 | 12,711 |
| Other chemical and allied industries | 32 | 2,354 | 33,195 | 43,461 |
| **Totals for Chemicals and Allied Products** | **1,237** | **37,768** | **260,637** | **507,697** |
| **Totals for All Industries** | **32,237** | **779,496** | **2,985,347** | **5,739,353** |

## 2 • CHICAGO INDUSTRIAL AREA

Comprising Cook, DuPage, Kane, Lake, and Will Counties in Illinois and Lake County in Indiana.

| Industry | No. of estab. | [1]No. of workers | [1,3]Cost of materials | [1]Value of products |
|---|---|---|---|---|
| Baking powder, yeast and other leavening compounds | 6 | 849 | 4,483 | 8,791 |
| Blacking, stains, and dressings [2] | 18 | 111 | 511 | 1,116 |
| Chemicals not elsewhere classified | 31 | 2,485 | 12,850 | 22,941 |
| Cleaning and polishing preparations | 47 | 365 | 1,871 | 4,887 |
| Compressed and liquefied gases | 17 | 245 | 784 | 3,441 |
| Drugs and medicines | 75 | 1,421 | 6,512 | 20,957 |
| Fertilizers [2] | 7 | 128 | 922 | 1,795 |
| Glue and gelatine | 17 | 750 | 3,828 | 6,389 |
| Grease and tallow, not incl. lubr. greases | 5 | 479 | 2,487 | 4,834 |
| Ink, printing | 33 | 378 | 4,009 | 7,192 |
| Oil cake and meal, linseed | 3 | 171 | 2,866 | 3,236 |
| Paints, pigments, and varnishes | 91 | 3,228 | 32,862 | 55,857 |
| Other chemical and allied industries | 169 | 4,280 | 36,312 | 70,677 |
| **Totals for Chemicals and Allied Products** | **519** | **14,890** | **110,297** | **212,313** |
| **Totals for All Industries** | **9,333** | **429,517** | **1,924,391** | **3,877,129** |

## 3 • PHILADELPHIA INDUSTRIAL AREA

Comprising the city of Philadelphia together with Bucks, Chester, Delaware, and Montgomery Counties in Pennsylvania and Burlington, Camden, and Gloucester Counties in New Jersey.

| Industry | No. of estab. | [1]No. of workers | [1,3]Cost of materials | [1]Value of products |
|---|---|---|---|---|
| Blacking, stains, and dressings | 7 | 90 | 405 | 654 |
| Chemicals not elsewhere classified | 32 | 2,604 | 21,397 | 36,246 |
| Cleaning and polishing preparations | 20 | 119 | 895 | 2,123 |
| Compressed and liquefied gases | 8 | 174 | 578 | 2,112 |
| Drugs and medicines | 40 | 1,967 | 6,506 | 23,162 |
| Fertilizers | 7 | 513 | 1,977 | 3,220 |
| Glue and gelatine | 8 | 285 | 1,101 | 2,236 |
| Grease and tallow, not incl. lubr. greases | 8 | 265 | 1,387 | 2,332 |
| Ink, printing | 15 | 307 | 2,083 | 3,594 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 26 | 173 | 724 | 2,544 |
| Mucilage, paste, and other adhesives except glue and rubber cement | 6 | 26 | 136 | 262 |
| Paints, pigments, and varnishes | 67 | 1,691 | 14,895 | 25,973 |
| Perfumes, cosmetics, and toilet preparations [2] | 18 | 116 | 685 | 1,125 |
| Soap | 19 | 849 | 6,615 | 12,229 |
| Tanning materials, natural dyestuffs, mordants and assistants, and sizes | 10 | 228 | 1,306 | 2,720 |
| Other chemical and allied industries | 22 | 4,985 | 12,999 | 26,212 |
| **Totals for Chemicals and Allied Products** | **331** | **14,392** | **74,639** | **146,744** |
| **Totals for All Industries** | **5,859** | **315,940** | **1,034,761** | **1,895,766** |

## 4 • BUFFALO INDUSTRIAL AREA

CHEMICAL
& METALLURGICAL
ENGINEERING
ESTABLISHED 1902
McGRAW-HILL PUBLISHING CO., INC.

# CHEMICAL PROCESS INDUSTRIES OF THE UNITED STATES

MORE than 60 per cent of all manufacturing activity in the United States centers in 33 so-called industrial areas. Each of these, as recently defined by the U. S. Census Bureau, comprises one or more contiguous counties in which at least 40,000 wage earners were reported in the Census of Manufactures for 1929.

Analyzing the most recent figures, the editors of *Chem. & Met.* have been able to segregate those belonging to the Census classification: "Chemicals and Allied Products" and find that in 1935 these industries manufactured 63.0 per cent of their products in the 33 designated areas. This compares with 60.4 per cent for all manufacturing industries.

To present a factual picture of the relative importance of these areas, they have been ranked and tabulated in the order of the total value of their output of "Chemicals and Allied Products." This numerical ranking has been indicated on the larger map to the right, primarily to show both localization and concentration of chemical industry in the United States. Relative importance of the various States in chemical manufacture has been stressed by the shading.

As students of Census statistics well know, Group VI, "Chemicals and Allied Products," fails to include petroleum refining, pulp and paper, rubber and other basic "Chemical Process Industries." Localization of these industries — important both as consumers of chemicals and users of chemical engineering equipment and technology — is evident from the series of small maps bordering this chart.

**CHEMICAL & METALLURGICAL ENGINEERING**
*Editorial Supplement to Vol. 45, No. 2, February, 1938.*

*Copyrighted by McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York, N. Y.*

## 7 • BOSTON INDUSTRIAL AREA

Comprising Essex, Middlesex, Norfolk, and Suffolk Counties in Massachusetts.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Blacking, stains, and dressings | 41 | 346 | 1,702 | 3,839 |
| Cleaning and polishing preparations | 18 | 45 | 216 | 585 |
| Drugs and medicines | 33 | 748 | 3,512 | 10,394 |
| Glue and gelatine | 10 | 803 | 3,653 | 6,471 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 17 | 76 | 419 | 928 |
| Oils not elsewhere classified | 4 | 14 | 224 | 397 |
| Paints, pigments, and varnishes (*) | 34 | 587 | 3,981 | 7,513 |
| Perfumes, cosmetics, and toilet preparations (*) | 16 | 90 | 247 | 766 |
| Other chemical and allied industries | 85 | 2,826 | 26,384 | 52,250 |
| **Totals for Chemicals and Allied Products** | 258 | 5,595 | 40,338 | 83,143 |
| **Totals for All Industries** | 5,225 | 230,277 | 658,356 | 1,268,094 |

## 8 • SAN FRANCISCO-OAKLAND INDUSTRIAL AREA

## 11 • CLEVELAND INDUSTRIAL AREA

Comprising Cuyahoga and Lorain Counties in Ohio.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Chemicals not elsewhere classified | 12 | 1,135 | 8,323 | 12,530 |
| Cleaning and polishing preparations | 16 | 98 | 510 | 1,292 |
| Compressed and liquefied gases | 9 | 184 | 316 | 1,718 |
| Drugs and medicines | 17 | 147 | 750 | 2,452 |
| Fertilizers | 3 | 100 | 802 | 1,106 |
| Grease and tallow, not incl. lubr. greases | 4 | 80 | 342 | 540 |
| Ink, printing | 4 | 40 | 222 | 565 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 16 | 42 | 410 | 1,046 |
| Paints, pigments, and varnishes | 45 | 1,378 | 10,030 | 20,407 |
| Perfumes, cosmetics, and toilet preparations | 11 | 71 | 426 | 831 |
| Soap | 4 | 35 | 241 | 386 |
| Other chemical and allied industries | 12 | 1,018 | 1,902 | 4,394 |
| **Totals for Chemicals and Allied Products** | 153 | 4,346 | 24,298 | 47,287 |
| **Totals for All Industries** | 2,384 | 140,090 | 456,766 | 862,498 |

## 15 • INDIANAPOLIS IND

Comprising Marion Co

| Industry | No. |
|---|---|
| Fertilizers | |
| Paints, pigments, and varnishes | |
| Perfumes, cosmetics and toilet preparations | |
| Other chemical and allied industries | |
| **Totals for Chemicals and Allied Products** | |
| **Totals for All Industries** | |

## 16 • MILWAUKEE IND

Comprising Kenosha, Milwaukee and

| Industry | No. |
|---|---|
| Blacking, stains and dressings | |

# NATION-WIDE PERSP

SOURCE: U

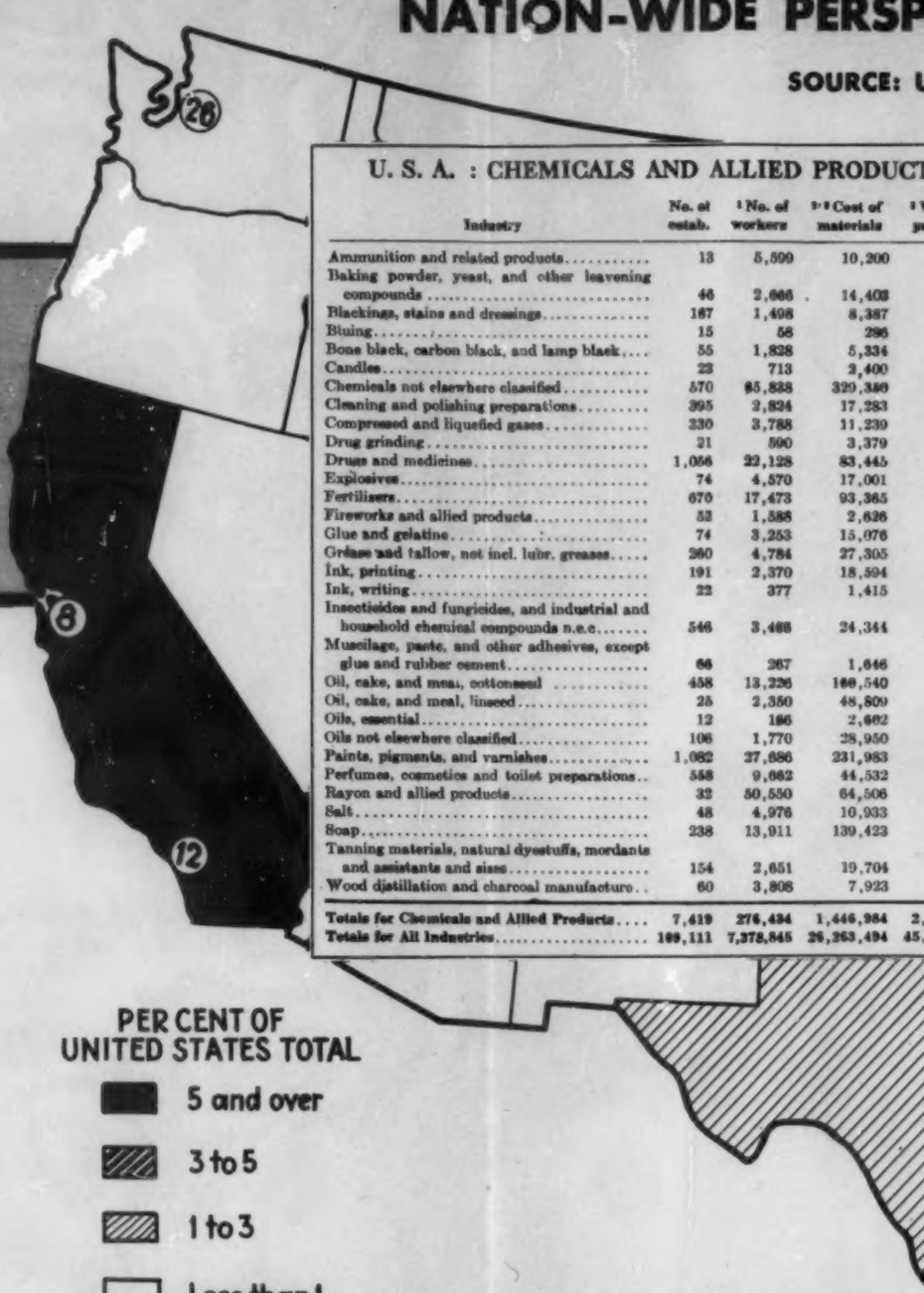
c.

# INDUSTRIES

# STATES

of the total value of their output of Allied Products." This numerical indicated on the larger map to the o show both localization and concen- l industry in the United States. Rel- of the various States in chemical been stressed by the shading.

Census statistics well know, Group nd Allied Products," fails to include g, pulp and paper, rubber and other Process Industries." Localization of —important both as consumers of ers of chemical engineering equip- logy—is evident from the series of ering this chart.




## U. S. A. : CHEMICALS AND ALLIED PRODUCT

| Industry | No. of estab. | [1]No. of workers | [2-3]Cost of materials | [3] |
|---|---|---|---|---|
| Ammunition and related products | 13 | 5,500 | 10,200 | |
| Baking powder, yeast, and other leavening compounds | 46 | 2,666 | 14,403 | |
| Blackings, stains and dressings | 167 | 1,498 | 8,387 | |
| Bluing | 15 | 58 | 286 | |
| Bone black, carbon black, and lamp black | 55 | 1,828 | 5,334 | |
| Candles | 23 | 713 | 2,400 | |
| Chemicals not elsewhere classified | 570 | 65,838 | 329,380 | |
| Cleaning and polishing preparations | 395 | 2,824 | 17,283 | |
| Compressed and liquefied gases | 330 | 3,788 | 11,239 | |
| Drug grinding | 21 | 590 | 3,379 | |
| Drugs and medicines | 1,056 | 22,128 | 83,445 | |
| Explosives | 74 | 4,570 | 17,001 | |
| Fertilisers | 670 | 17,473 | 93,365 | |
| Fireworks and allied products | 52 | 1,588 | 2,626 | |
| Glue and gelatine | 74 | 3,253 | 15,076 | |
| Grease and tallow, not incl. lubr. greases | 260 | 4,784 | 27,305 | |
| Ink, printing | 191 | 2,370 | 18,594 | |
| Ink, writing | 22 | 377 | 1,415 | |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 546 | 3,488 | 24,344 | |
| Mucilage, paste, and other adhesives, except glue and rubber cement | 66 | 267 | 1,646 | |
| Oil, cake, and meal, cottonseed | 458 | 13,236 | 160,540 | |
| Oil, cake, and meal, linseed | 25 | 2,350 | 48,809 | |
| Oils, essential | 12 | 186 | 2,602 | |
| Oils not elsewhere classified | 106 | 1,770 | 28,950 | |
| Paints, pigments, and varnishes | 1,082 | 27,686 | 231,983 | |
| Perfumes, cosmetics and toilet preparations | 558 | 9,662 | 44,532 | |
| Rayon and allied products | 32 | 50,550 | 64,506 | |
| Salt | 48 | 4,976 | 10,933 | |
| Soap | 238 | 13,911 | 139,423 | |
| Tanning materials, natural dyestuffs, mordants and assistants and sizes | 154 | 2,651 | 19,704 | |
| Wood distillation and charcoal manufacture | 60 | 3,808 | 7,923 | |
| **Totals for Chemicals and Allied Products** | 7,419 | 276,434 | 1,446,984 | 2, |
| **Totals for All Industries** | 169,111 | 7,378,845 | 26,263,494 | 45, |

## STRIAL AREA

ounties in Ohio.

| [1]No. of workers | [2-3]Cost of materials | [3]Value of products |
|---|---|---|
| 1,135 | 8,323 | 12,530 |
| 98 | 519 | 1,292 |
| 194 | 316 | 1,718 |
| 147 | 750 | 2,452 |
| 109 | 802 | 1,108 |
| 80 | 342 | 540 |
| 40 | 222 | 365 |
| 42 | 410 | 1,046 |
| 1,378 | 10,030 | 20,407 |
| 71 | 426 | 831 |
| 33 | 241 | 388 |
| 1,018 | 1,902 | 2,208 |
| 4,346 | 34,292 | 47,287 |
| 149,699 | 436,766 | 862,498 |

## 15 • INDIANAPOLIS INDUSTRIAL AREA

Comprising Marion County, Indiana only.

| Industry | No. of estab. | [1]No. of workers | [2-3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Fertilisers | 3 | 86 | 739 | 1,196 |
| Paints, pigments, and varnishes | 14 | 262 | 2,228 | 3,804 |
| Perfumes, cosmetics and toilet preparations | 7 | 26 | 54 | 162 |
| Other chemical and allied industries | 36 | 1,600 | 5,881 | 23,437 |
| **Totals for Chemicals and Allied Products** | 60 | 1,974 | 8,902 | 28,599 |
| **Totals for All Industries** | 736 | 36,528 | 125,540 | 238,388 |

## 16 • MILWAUKER INDUSTRIAL AREA

Comprising Kenosha, Milwaukee and Racine Counties in Wisconsin.

| Industry | No. of estab. | [1]No. of workers | [2-3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Blacking, stains and dressings | 5 | 39 | 256 | 553 |
| Paints, pigments, and varnishes | b7 | 1,691 | 14,895 | 25,973 |
| Perfumes, cosmetics, and toilet prepara- | | | | |

## 20 • PROVIDENCE-FALL RIVER-NEW BEDFORD INDUSTRIAL AREA

Comprising Providence County in Rhode Island and Bristol County in Massachusett

| Industry | No. of estab. | [1]No. of workers | [2-3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Drugs and medicines | 5 | 23 | 36 | 1 |
| Paints, pigments and varnishes | 14 | 128 | 1,235 | 2,2 |
| Tanning materials, natural dyestuffs, mordants and assistants, and sizes | 10 | 85 | 873 | 1,2 |
| Other chemical and allied industries | 26 | 1,352 | 4,705 | 9,4 |
| **Totals for Chemicals and Allied Products** | 55 | 1,588 | 6,849 | 13,1 |
| **Totals for All Industries** | 1,965 | 142,661 | 277,677 | 535,4 |

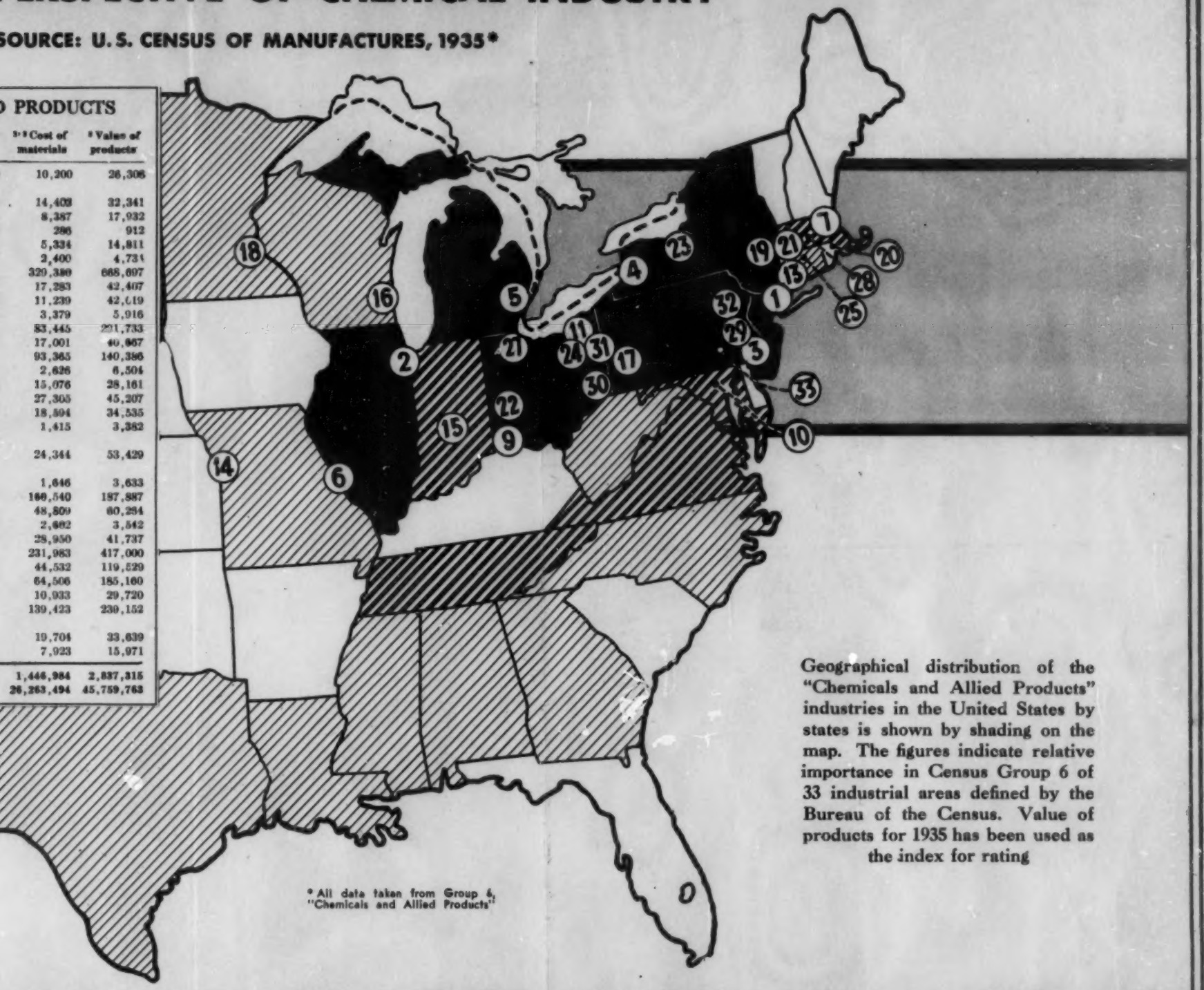
## 21 • SPRINGFIELD-HOLYOKE INDUSTRIAL AREA

Comprising Hampden County, Massachusetts only.

| Industry | No. of estab. | [1]No. of workers | [2-3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Insecticides and | | | | |
| and household | | | | |
| Oils not elsewher | | | | |

# PERSPECTIVE OF CHEMICAL INDUSTRY

SOURCE: U. S. CENSUS OF MANUFACTURES, 1935*




* All data taken from Group 6, "Chemicals and Allied Products"

**Geographical distribution of the "Chemicals and Allied Products" industries in the United States by states is shown by shading on the map. The figures indicate relative importance in Census Group 6 of 33 industrial areas defined by the Bureau of the Census. Value of products for 1935 has been used as the index for rating**

## ... PRODUCTS

| [1] [3] Cost of materials | [3] Value of products |
|---|---|
| 10,200 | 26,306 |
| 14,403 | 32,341 |
| 8,387 | 17,932 |
| 286 | 912 |
| 5,334 | 14,811 |
| 2,400 | 4,731 |
| 329,380 | 668,697 |
| 17,283 | 42,407 |
| 11,239 | 42,019 |
| 3,379 | 5,916 |
| 83,445 | 221,733 |
| 17,001 | 40,867 |
| 93,365 | 140,386 |
| 2,626 | 6,504 |
| 15,076 | 28,161 |
| 27,305 | 45,207 |
| 18,594 | 34,535 |
| 1,415 | 3,362 |
| 24,344 | 53,429 |
| 1,646 | 3,633 |
| 160,540 | 197,887 |
| 48,809 | 60,254 |
| 2,682 | 3,542 |
| 28,950 | 41,737 |
| 231,983 | 417,000 |
| 44,532 | 119,529 |
| 64,506 | 185,160 |
| 10,933 | 29,720 |
| 139,423 | 230,152 |
| 19,704 | 33,639 |
| 7,923 | 15,971 |
| 1,446,984 | 2,837,315 |
| 26,263,494 | 45,759,763 |

## ...EDFORD

...y in Massachusetts

| ...st of ...erials | [3] Value of products |
|---|---|
| 36 | 173 |
| 1,235 | 2,210 |
| 873 | 1,245 |
| 4,705 | 9,409 |
| 6,849 | 13,127 |
| 77,477 | 535,467 |

## 26 • SEATTLE-TACOMA INDUSTRIAL AREA

Comprising King and Pierce Counties in Washington.

| Industry | No. of estab. | [1] No. of workers | [1] [3] Cost of materials | [3] Value of products |
|---|---|---|---|---|
| Chemicals not elsewhere classified (*) | 7 | 155 | 848 | 1,060 |
| Drugs and medicines (*) | 6 | 13 | 37 | 136 |
| Fertilizers (*) | 5 | 29 | 214 | 380 |
| Glue and gelatine | 4 | 57 | 401 | 778 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 3 | 3 | 16 | 36 |
| Perfumes, cosmetics and toilet preparations | 6 | 16 | 59 | 170 |
| Soap (*) | 4 | 36 | 242 | 412 |
| Other chemical and allied industries | 27 | 490 | 1,658 | 3,875 |
| **Totals for Chemicals and Allied Products** | 62 | 799 | 3,475 | 7,746 |
| **Totals for All Industries** | 1,373 | 31,879 | 135,142 | 224,109 |

## 31 • YOUNGSTOWN INDUSTRIAL AREA

Comprising Mahoning and Trumbull Counties in Ohio, and Lawrence and Mercer Counties in Pennsylvania.

| Industry | No. of estab. | [1] No. of workers | [1] [3] Cost of materials | [3] Value of products |
|---|---|---|---|---|
| Greases and tallow, not incl. lubr. greases | 3 | 31 | 58 | 145 |
| Other chemical and allied industries | 14 | 316 | 1,283 | 2,857 |
| **Totals for Chemicals and Allied Products** | 17 | 347 | 1,340 | 3,001 |
| **Totals for All Industries** | 434 | 61,436 | 288,093 | 422,869 |

## 32 • SCRANTON-WILKES BARRE INDUSTRIAL AREA

Comprising Lackawanna and Luzerne Counties in Pennsylvania.

| Industry | No. of estab. | [1] No. of workers | [1] [3] Cost of materials | [3] Value of products |
|---|---|---|---|---|
| Grease and tallow, not incl. lubr. greases | 4 | 25 | 57 | 130 |
| Insecticides and fungicides, and industrial | | | | |

## ...AL AREA

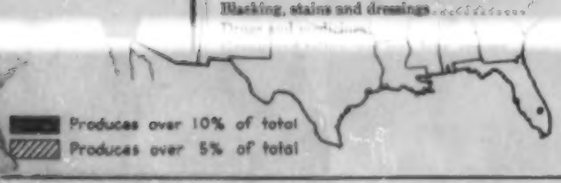
...nly.

| ...ost of ...erials | [3] Value of products |
|---|---|

| ...Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 17 | 76 | 419 | 928 |
|---|---|---|---|---|

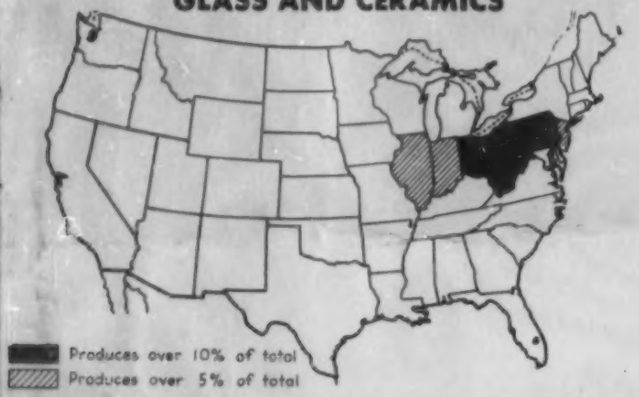
| ...Fertilizers | 3 | 109 | 802 | 1,108 |
|---|---|---|---|---|
| Grease and tallow, not incl. lubr. greases | 4 | 89 | 342 | 549 |

| **Totals for Chemicals and Allied Products** | 60 |
|---|---|




| Industry | | | | |
|---|---|---|---|---|
| Paints, pigments, and varnishes | 67 | 1,601 | 14,895 | 25,973 |
| Perfumes, cosmetics, and toilet preparations (*) | 18 | 116 | 685 | 1,125 |
| Soap | 19 | 849 | 6,615 | 12,229 |
| Tanning materials, natural dyestuffs, mordants and assistants, and sizes | 19 | 228 | 1,366 | 2,720 |
| Other chemical and allied industries | 22 | 4,985 | 12,999 | 26,212 |
| **Totals for Chemicals and Allied Products** | **331** | **14,392** | **74,639** | **146,744** |
| **Totals for All Industries** | **5,859** | **315,940** | **1,034,761** | **1,895,766** |

## GLASS AND CERAMICS

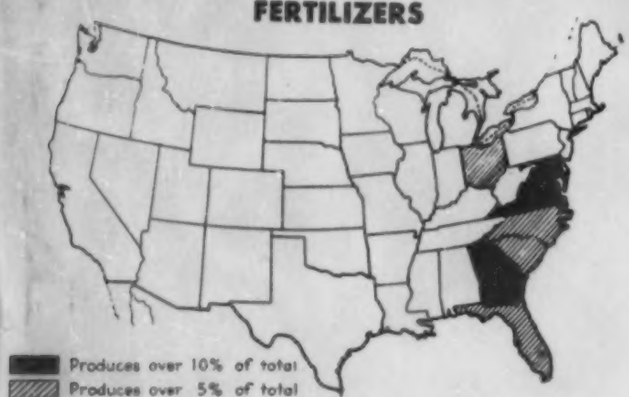



## 4 • BUFFALO INDUSTRIAL AREA

Comprising Erie and Niagara Counties in New York.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Chemicals not elsewhere classified | 27 | 5,426 | 28,285 | 64,705 |
| Cleaning and polishing preparations | 8 | 74 | 362 | 787 |
| Drugs and medicines | 22 | 423 | 1,402 | 5,719 |
| Fertilizers | 4 | 133 | 934 | 1,203 |
| Grease and tallow, not incl. lubr. greases | 4 | 96 | 599 | 915 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 7 | 16 | 104 | 352 |
| Oil, cake, and meal, linseed | 3 | 125 | 2,353 | 2,587 |
| Paints, pigments, and varnishes | 11 | 422 | 2,930 | 5,667 |
| Other chemical and allied industries | 26 | 2,119 | 4,773 | 12,853 |
| **Totals for Chemicals and Allied Products** | **112** | **8,834** | **41,841** | **94,788** |
| **Totals for All Industries** | **1,443** | **82,378** | **483,529** | **758,706** |

## FERTILIZERS




## 5 • DETROIT INDUSTRIAL AREA

Comprising Wayne and Oakland Counties in Michigan.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Cleaning and polishing preparations (*) | 22 | 323 | 2,605 | 4,097 |
| Compressed and liquefied gases | 8 | 179 | 399 | 1,602 |
| Grease and tallow, not incl. lubr. greases | 5 | 234 | 801 | 1,653 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 13 | 34 | 120 | 373 |
| Soap | 5 | 8 | 87 | 123 |
| Other chemical and allied industries | 95 | 7,376 | 34,493 | 85,493 |
| **Totals for Chemicals and Allied Products** | **148** | **8,154** | **38,505** | **93,941** |
| **Totals for All Industries** | **2,517** | **331,505** | **1,637,221** | **2,675,195** |

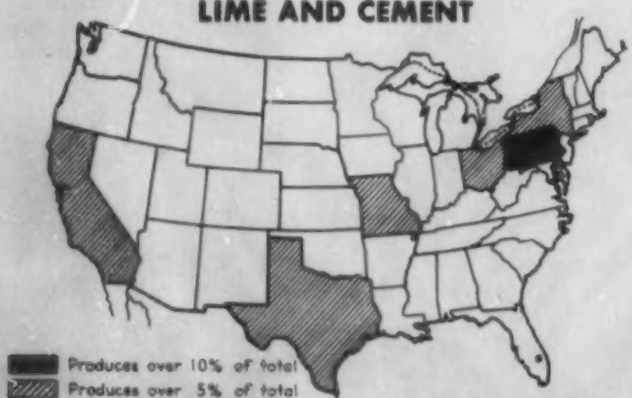
## LEATHER

## 6 • ST. LOUIS INDUSTRIAL AREA

Comprising the city of St. Louis and St. Louis County in Missouri and Madison and St. Clair Counties in Illinois.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Chemicals not elsewhere classified | 12 | 2,929 | 12,458 | 25,937 |
| Cleaning and polishing preparations | 17 | 64 | 476 | 1,239 |
| Compressed and liquefied gases | 8 | 99 | 291 | 1,191 |
| Drugs and medicines | 33 | 1,153 | 5,280 | 18,213 |
| Fertilizers | 6 | 163 | 982 | 1,557 |
| Grease and tallow, not incl. lubr. greases | 5 | 90 | 261 | 652 |
| Ink, printing | 7 | 41 | 251 | 549 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 15 | 80 | 714 | 1,612 |
| Paints, pigments, and varnishes | 35 | 1,449 | 8,554 | 17,633 |
| Perfumes, cosmetics and toilet preparations | 21 | 275 | 1,008 | 1,977 |
| Other chemical and allied industries | 34 | 1,800 | 7,170 | 15,579 |
| **Totals for Chemicals and Allied Products** | **193** | **8,143** | **37,505** | **86,139** |
| **Totals for All Industries** | **2,555** | **116,683** | **540,065** | **887,734** |

## LIME AND CEMENT




## OILS AND FATS

| | | | | |
|---|---|---|---|---|
| **Totals for Chemicals and Allied Products** | **55** | **1,588** | **6,849** | |
| **Totals for All Industries** | **1,965** | **142,661** | **277,677** | |

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 17 | 76 | 419 | 928 |
| Oils not elsewhere classified | 4 | 14 | 224 | 397 |
| Paints, pigments, and varnishes [b] | 34 | 587 | 3,981 | 7,513 |
| Perfumes, cosmetics, and toilet preparations [b] | 16 | 90 | 247 | 765 |
| Other chemical and allied industries | 85 | 2,826 | 26,384 | 52,250 |
| **Totals for Chemicals and Allied Products** | **258** | **5,595** | **40,238** | **83,145** |
| **Totals for All Industries** | **5,225** | **230,277** | **650,356** | **1,348,094** |

## 8 • SAN FRANCISCO-OAKLAND INDUSTRIAL AREA

Comprising Alameda, Contra Costa, Marin, San Francisco, and San Mateo Counties in California.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Chemicals not elsewhere classified | 22 | 1,270 | 5,500 | 12,236 |
| Cleaning and polishing preparations | 9 | 19 | 86 | 182 |
| Compressed and liquefied gases | 10 | 100 | 400 | 1,263 |
| Drugs and medicines | 20 | 181 | 511 | 1,642 |
| Explosives [c] | 4 | 399 | 2,045 | 4,923 |
| Grease and tallow, not incl. lubr. greases | 6 | 134 | 709 | 1,298 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c | 18 | 164 | 1,500 | 2,536 |
| Oils not elsewhere classified | 15 | 378 | 4,763 | 8,931 |
| Paints, pigments, and varnishes | 44 | 830 | 9,556 | 17,271 |
| Perfumes, cosmetics, and toilet preparations | 5 | 57 | 228 | 607 |
| Salt | 4 | 360 | 796 | 2,296 |
| Other chemical and allied industries | 35 | 1,036 | 7,020 | 13,478 |
| **Totals for Chemicals and Allied Products** | **192** | **4,624** | **33,132** | **66,661** |
| **Totals for All Industries** | **3,142** | **78,690** | **534,491** | **829,371** |

## 9 • CINCINNATI INDUSTRIAL AREA

Comprising Butler and Hamilton Counties in Ohio, and Campbell and Kenton Counties in Kentucky.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Chemicals not elsewhere classified | 13 | 935 | 5,720 | 10,727 |
| Compressed and liquefied gases | 7 | 69 | 175 | 801 |
| Drugs and medicines | 16 | 264 | 1,070 | 2,820 |
| Fertilizers | 5 | 290 | 1,910 | 3,050 |
| Ink, printing | 8 | 117 | 687 | 1,394 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 9 | 43 | 262 | 663 |
| Paints, pigments, and varnishes | 22 | 466 | 4,565 | 7,118 |
| Other chemical and allied industries | 37 | 2,842 | 20,770 | 34,356 |
| **Totals for Chemicals and Allied Products** | **117** | **5,026** | **35,159** | **60,929** |
| **Totals for All Industries** | **1,744** | **86,941** | **368,730** | **625,780** |

## 10 • BALTIMORE INDUSTRAL AREA

Comprising the independent city of Baltimore and Baltimore County in Maryland.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Chemicals not elsewhere classified [c] | 12 | 1,164 | 8,032 | 11,921 |
| Drugs and medicines | 20 | 450 | 1,965 | 8,073 |
| Fertilizers | 14 | 2,032 | 8,805 | 14,700 |
| Insecticides and fungicides, and industrial and household chem. compounds n.e.c. [b] | 13 | 150 | 1,056 | 2,010 |
| Paints, pigments, and varnishes | 20 | 656 | 3,498 | 9,058 |
| Other chemical and allied industries | 41 | 967 | 7,325 | 12,279 |
| **Totals for Chemicals and Allied Products** | **120** | **5,419** | **30,791** | **58,041** |
| **Totals for All Industries** | **1,928** | **86,088** | **368,462** | **627,326** |

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Fertilizers | 3 | 109 | 802 | 1,108 |
| Grease and tallow, not incl. lubr. greases | 4 | 80 | 342 | 540 |
| Ink, printing | 4 | 40 | 222 | 565 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 16 | 42 | 410 | 1,046 |
| Paints, pigments, and varnishes | 45 | 1,378 | 10,030 | 20,407 |
| Perfumes, cosmetics, and toilet preparations | 11 | 71 | 426 | 831 |
| Soap | 4 | 35 | 241 | 386 |
| Other chemical and allied industries | 12 | 1,018 | 1,902 | 4,394 |
| **Totals for Chemicals and Allied Products** | **153** | **4,346** | **24,292** | **47,287** |
| **Totals for All Industries** | **2,384** | **140,090** | **456,766** | **862,498** |

## 12 • LOS ANGELES INDUSTRIAL AREA

Comprising Los Angeles County in California only.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Blacking, stains and dressings [c] | 7 | 23 | 164 | 343 |
| Chemicals not elsewhere classified | 20 | 551 | 2,272 | 6,214 |
| Cleaning and polishing preparations [c] | 15 | 41 | 297 | 712 |
| Compressed and liquefied gases | 13 | 113 | 470 | 1,588 |
| Drugs and medicines [b] | 31 | 240 | 720 | 2,208 |
| Fertilizers | 18 | 146 | 1,528 | 2,540 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 26 | 93 | 613 | 1,081 |
| Oils not elsewhere classified | 7 | 226 | 3,531 | 6,023 |
| Paints, pigments, and varnishes | 51 | 495 | 5,048 | 8,237 |
| Perfumes, cosmetics, and toilet preparations [c] | 27 | 319 | 1,409 | 3,587 |
| Other chemical and allied industries | 42 | 820 | 7,458 | 11,820 |
| **Totals for Chemicals and Allied Products** | **257** | **3,067** | **23,510** | **44,373** |
| **Totals for All Industries** | **4,443** | **109,469** | **540,310** | **1,009,071** |

## 13 • BRIDGEPORT-NEW HAVEN-WATERBURY INDUSTRIAL AREA

Comprising Fairfield and New Haven Counties in Connecticut.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Chemicals not elsewhere classified [b] | 11 | 673 | 4,295 | 6,143 |
| Fertilizers | 3 | 108 | 725 | 1,032 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 5 | 28 | 153 | 511 |
| Other chemical and allied industries | 34 | 3,307 | 10,310 | 25,827 |
| **Totals for Chemicals and Allied Products** | **53** | **4,176** | **15,483** | **33,513** |
| **Totals for All Industry** | **1,644** | **123,074** | **245,207** | **535,353** |

## 14 • KANSAS CITY INDUSTRIAL AREA

Comprising Clay and Jackson Counties in Missouri and Wyandotte County in Kansas.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Cleaning and polishing preparations | 6 | 33 | 128 | 258 |
| Compressed and liquefied gases | 8 | 73 | 276 | 961 |
| Drugs and medicines | 30 | 245 | 892 | 2,460 |
| Ink, printing | 4 | 29 | 232 | 390 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 12 | 40 | 273 | 735 |
| Paints, pigments, and varnishes | 13 | 338 | 2,874 | 5,454 |
| Perfumes, cosmetics, and toilet preparations [b] | 15 | 101 | 416 | 2,344 |
| Other chemical and allied industries | 13 | (4) | (4) | (4) |
| **Totals for Chemicals and Allied Products** | **101** | (4) | (4) | (4) |
| **Totals for All Industries** | **1,010** | **38,787** | **353,921** | **479,668** |

| Industry | No. of estab. |
|---|---|
| Totals for Chemicals and Allied Products | 60 |
| Totals for All Industries | 736 |

## 16 • MILWAUKEE INDUST

Comprising Kenosha, Milwaukee and Racin

| Industry | No. of estab. |
|---|---|
| Blacking, stains and dressings | 5 |
| Drugs and medicines | 6 |
| Grease and tallow, not incl. lubr. greases | 6 |
| Insecticides and fungicides, and industrial and household chem. compounds n.e.c. [b] | 9 |
| Paints, pigments, and varnishes | 14 |
| Soap [c] | 5 |
| Other chemical and allied industries | 36 |
| **Totals for Chemicals and Allied Products** | **81** |
| **Totals for All Industries** | **1,790** |

## 17 • PITTSBURGH INDUST

Comprising Allegany, Beaver, Washington and West

| Industry | No. of estab. |
|---|---|
| Ammunition and related products | 3 |
| Chemicals not elsewhere classified | 14 |
| Cleaning and polishing preparations | 7 |
| Compressed and liquefied gases | 14 |
| Drugs and medicines | 11 |
| Grease and tallow, not incl. lubr. greases | 5 |
| Insecticides and fungicides, and industrial and household chem. compounds n.e.c. | 6 |
| Paints, pigments, and varnishes | 17 |
| Perfumes, cosmetics, and toilet preparations | 4 |
| Soap | 3 |
| Other chemical and allied industries | 11 |
| **Totals for Chemicals and Allied Products** | **95** |
| **Totals for All Industries** | **1,946** |

## 18 • MINNEAPOLIS-ST. PAUL

Comprising Dakota, Hennepin, and Ramsey

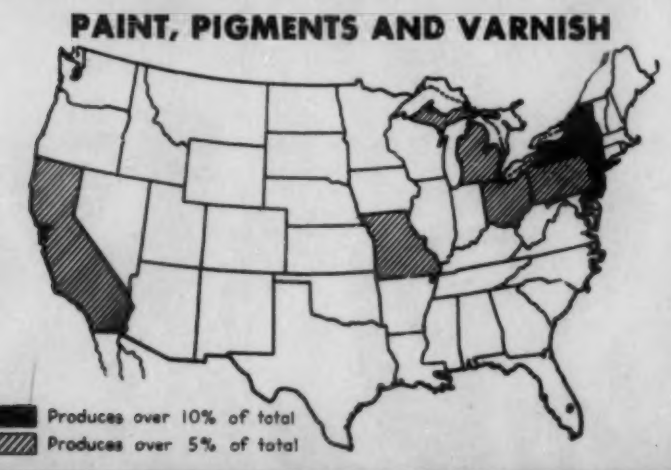
| Industry | No. of estab. |
|---|---|
| Cleaning and polishing preparations | 4 |
| Grease and tallow, not incl. lubr. greases | 5 |
| Perfumes, cosmetics, and toilet preps. [b] | 17 |
| Soap | 6 |
| Other chemical and allied industries | 64 |
| **Totals for Chemicals and Allied Products** | **96** |
| **Totals for All Industries** | **1,645** |

## 19 • ALBANY-SCHENECTADY-TRO

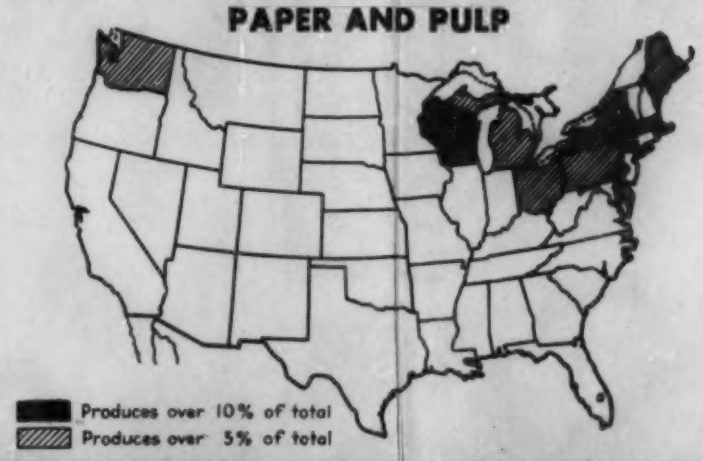
Comprising Albany, Rensselaer, and Schenect

| Industry | No. of estab. |
|---|---|
| All Chemicals and Allied Products | 27 |
| **Totals for All Industries** | **595** |

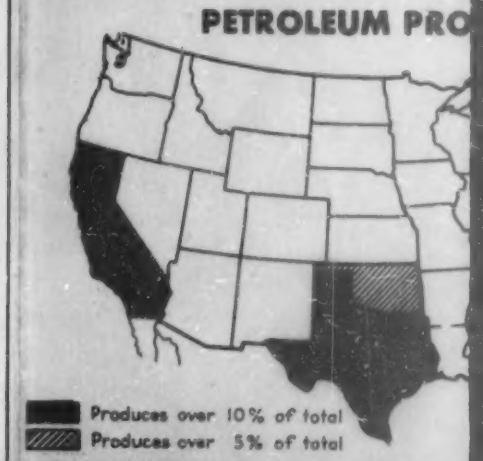
## PAINT, PIGMENTS AND VARNISH




## PAPER AND PULP




## PETROLEUM PRO




| | | | | | |
|---|---|---|---|---|---|
| 9,849 | 13,127 | Soap [c] | 4 | 36 | 242 | 412 |
| 277,677 | 535,467 | Other chemical and allied industries | 27 | 400 | 1,858 | 3,875 |

| | | | |
|---|---|---|---|
| 4 | 30 | 342 | |
| 4 | 40 | 222 | |
| 16 | 42 | 410 | 1,046 |
| 45 | 1,378 | 10,030 | 20,407 |
| 11 | 71 | 426 | 831 |
| 4 | 35 | 241 | 386 |
| 12 | 1,018 | 1,902 | 4,394 |
| 53 | 4,346 | 24,292 | 47,287 |
| 84 | 140,096 | 456,766 | 862,498 |

## INDUSTRIAL AREA

n California only.

| of | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|
| 7 | 23 | 164 | 343 |
| 30 | 551 | 2,272 | 6,214 |
| 5 | 41 | 297 | 712 |
| 13 | 113 | 470 | 1,388 |
| 11 | 240 | 720 | 2,208 |
| 18 | 148 | 1,528 | 2,540 |
| 26 | 93 | 613 | 1,081 |
| 7 | 226 | 3,531 | 6,033 |
| 51 | 455 | 5,048 | 8,257 |
| 27 | 319 | 1,409 | 3,587 |
| 42 | 820 | 7,458 | 11,820 |
| 37 | 3,067 | 23,510 | 44,373 |
| 43 | 109,469 | 540,310 | 1,009,071 |

## AVEN-WATERBURY AREA

Counties in Connecticut.

| of | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|
| 1 | 673 | 4,295 | 6,143 |
| 3 | 108 | 725 | 1,032 |
| 5 | 28 | 153 | 511 |
| 34 | 3,367 | 10,310 | 25,827 |
| 53 | 4,176 | 15,483 | 33,513 |
| 44 | 123,674 | 245,297 | 535,353 |

## INDUSTRIAL AREA

ri and Wyandotte County in Kansas.

| of | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|
| 6 | 33 | 128 | 258 |
| 8 | 73 | 276 | 961 |
| 10 | 245 | 892 | 2,460 |
| 4 | 29 | 232 | 390 |
| 12 | 40 | 273 | 733 |
| 13 | 338 | 2,874 | 5,454 |
| 15 | 101 | 416 | 2,344 |
| 3 | (4) | (4) | (4) |
| 1 | (4) | (4) | (4) |
| 30 | 38,787 | 353,921 | 479,668 |

## 16 • MILWAUKEE INDUSTRIAL AREA

Comprising Kenosha, Milwaukee and Racine Counties in Wisconsin.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Blacking, stains and dressings | 5 | 30 | 250 | 553 |
| Drugs and medicines | 6 | 53 | 187 | 450 |
| Grease and tallow, not incl. lubr. greases | 6 | 76 | 530 | 936 |
| Insecticides and fungicides, and industrial and household chem. compounds n.e.c. (5) | 9 | 24 | 111 | 272 |
| Paints, pigments, and varnishes | 14 | 530 | 5,923 | 8,801 |
| Soap (5) | 5 | 33 | 183 | 312 |
| Other chemical and allied industries | 36 | 1,285 | 6,032 | 17,071 |
| **Totals for Chemicals and Allied Products** | **81** | **2,043** | **13,216** | **28,400** |
| **Totals for All Industries** | **1,799** | **101,734** | **318,919** | **613,652** |

## 17 • PITTSBURGH INDUSTRIAL AREA

Comprising Allegany, Beaver, Washington, and Westmoreland Counties in Pennsylvania

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Ammunition and related products | 3 | 179 | 291 | 998 |
| Chemicals not elsewhere classified | 14 | 919 | 8,257 | 14,611 |
| Cleaning and polishing preparations | 7 | 24 | 87 | 207 |
| Compressed and liquefied gases | 14 | 243 | 604 | 2,547 |
| Drugs and medicines | 11 | 167 | 455 | 1,246 |
| Grease and tallow, not incl. lubr. greases | 5 | 163 | 391 | 747 |
| Insecticides and fungicides, and industrial and household chem. compounds n.e.c. | 6 | 27 | 84 | 202 |
| Paints, pigments, and varnishes | 17 | 481 | 3,150 | 5,490 |
| Perfumes, cosmetics, and toilet preparations | 4 | 27 | 136 | 207 |
| Soap | 3 | 58 | 213 | 529 |
| Other chemical and allied industries | 11 | 92 | 1,138 | 1,639 |
| **Totals for Chemicals and Allied Products** | **95** | **2,380** | **14,806** | **24,416** |
| **Totals for All Industries** | **1,946** | **179,320** | **591,897** | **1,049,319** |

## 18 • MINNEAPOLIS-ST. PAUL INDUSTRIAL AREA

Comprising Dakota, Hennepin, and Ramsey Counties in Minnesota.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Cleaning and polishing preparations | 4 | 7 | 47 | 118 |
| Grease and tallow, not incl. lubr. greases | 5 | 20 | 77 | 194 |
| Perfumes, cosmetics, and toilet preps. (5) | 17 | 100 | 516 | 1,529 |
| Soap | 6 | 40 | 403 | 944 |
| Other chemical and allied industries | 64 | 888 | 11,858 | 19,262 |
| **Totals for Chemicals and Allied Products** | **96** | **1,054** | **12,901** | **22,047** |
| **Totals for All Industries** | **1,645** | **49,791** | **299,841** | **444,815** |

## 19 • ALBANY-SCHENECTADY-TROY INDUSTRIAL AREA

Comprising Albany, Rensselaer, and Schenectady Counties in New York.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| All Chemicals and Allied Products | 27 | 1,342 | 8,286 | 17,141 |
| Totals for All Industries | 595 | 40,210 | 98,138 | 214,143 |
| **Totals for Chemicals and Allied Products** | **55** | **1,588** | **8,849** | **1** |
| **Totals for All Industries** | **1,965** | **142,661** | **277,677** | **53** |

## 21 • SPRINGFIELD-HOLYOKE INDUSTRIAL AREA

Comprising Hampden County, Massachusetts only.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Val prod |
|---|---|---|---|---|
| Paints, pigments, and varnishes | 5 | 30 | 368 | |
| Other chemical and allied industries | 19 | 876 | 6,052 | 1 |
| **Totals for Chemicals and Allied Products** | **24** | **906** | **6,420** | **1** |
| **Totals for All Industries** | **596** | **40,537** | **96,234** | **15** |

## 22 • DAYTON INDUSTRIAL AREA

Comprising Montgomery County, Ohio only.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Val prod |
|---|---|---|---|---|
| Drugs and medicines | 8 | 32 | 103 | |
| Soap | 4 | 401 | 2,888 | |
| Other chemical and allied industries | 16 | 344 | 2,829 | |
| **Totals for Chemicals and Allied Products** | **28** | **777** | **5,820** | **1** |
| **Totals for All Industries** | **436** | **34,336** | **83,421** | **2** |

## 23 • ROCHESTER INDUSTRIAL AREA

Comprising Monroe County, New York only.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Val prod |
|---|---|---|---|---|
| Drugs and medicines | 8 | 43 | 131 | |
| Paints, pigments, and varnishes | 4 | 5 | 31 | |
| Other chemical and allied industries | 23 | 444 | 6,819 | |
| **Totals for Chemicals and Allied Products** | **35** | **492** | **6,981** | |
| **Totals for All Industries** | **790** | **44,963** | **102,229** | **2** |

## 24 • AKRON INDUSTRIAL AREA

Comprising Summit County in Ohio only.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Val prod |
|---|---|---|---|---|
| **All Chemicals and Allied Products** | **15** | **1,113** | **4,947** | |
| **Totals for All Industries** | **302** | **49,898** | **192,216** | **3** |

## 25 • HARTFORD INDUSTRIAL AREA

Comprising Hartford County in Connecticut only.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Val prod |
|---|---|---|---|---|
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 3 | 4 | 37 | |
| Other chemical and allied industries | 16 | 1,238 | 3,810 | |
| **Totals for Chemicals and Allied Products** | **19** | **1,242** | **3,847** | |
| **Totals for All Industries** | **670** | **55,225** | **81,445** | **2** |

| | | | | |
|---|---|---|---|---|
| | 6,849 | 13,127 | | |
| | 277,677 | 535,467 | | |

## RIAL AREA

...e only.

| | [2]Cost of materials | [3]Value of products |
|---|---|---|
| | 368 | 563 |
| | 6,052 | 10,380 |
| | 6,420 | 11,443 |
| | 96,234 | 196,715 |

## REA

...y.

| | [2]Cost of materials | [3]Value of products |
|---|---|---|
| | 103 | 382 |
| | 2,858 | 4,147 |
| | 2,829 | 5,802 |
| | 5,829 | 10,311 |
| | 83,421 | 294,934 |

## AREA

...ly.

| | [2]Cost of materials | [3]Value of products |
|---|---|---|
| | 131 | 520 |
| | 31 | 56 |
| | 6,819 | 9,018 |
| | 6,981 | 9,596 |
| | 102,920 | 241,628 |

## A

| | [2]Cost of materials | [3]Value of products |
|---|---|---|
| | 4,947 | 9,273 |
| | 193,216 | 366,163 |

## AREA

...only.

| | [2]Cost of materials | [3]Value of products |
|---|---|---|
| | 37 | 77 |
| | 3,810 | 8,064 |
| | 3,847 | 9,141 |
| | 81,445 | 216,890 |

| | | | | |
|---|---|---|---|---|
| Soap (*) | 4 | 36 | 242 | 412 |
| Other chemical and allied industries | 27 | 400 | 1,656 | 3,875 |
| **Totals for Chemicals and Allied Products** | **62** | **799** | **3,475** | **7,746** |
| **Totals for All Industries** | **1,373** | **31,879** | **135,142** | **224,160** |

## 27 • TOLEDO INDUSTRIAL AREA

Comprising Lucas County, Ohio only.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Compressed and liquefied gases | 3 | 17 | 57 | 196 |
| Other chemical and allied industries | 20 | 469 | 3,617 | 6,971 |
| **Totals for Chemicals and Allied Products** | **23** | **486** | **3,674** | **7,167** |
| **Totals for All Industries** | **512** | **37,917** | **134,956** | **252,186** |

## 28 • WORCESTER INDUSTRIAL AREA

Comprising Worcester County in Massachusetts only.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| **All Chemicals and Allied Products** | **21** | **1,533** | **2,929** | **7,013** |
| **Totals for All Industries** | **1,049** | **73,827** | **150,493** | **305,008** |

## 29 • ALLENTOWN-BETHLEHEM INDUSTRIAL AREA

Comprising Lehigh and Northampton Counties in Pennsylvania.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Paints, pigments, and varnishes | 5 | 404 | 1,390 | 2,450 |
| Other chemical and allied industries | 16 | 367 | 1,525 | 2,619 |
| **Totals for Chemicals and Allied Products** | **21** | **771** | **2,915** | **5,069** |
| **Totals for All Industries** | **588** | **48,818** | **92,259** | **190,003** |

## 30 • WHEELING INDUSTRIAL AREA

Comprising Brooks, Hancock and Ohio Counties in West Virginia and Belmont, Columbiana, and Jefferson Counties in Ohio.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Chemicals not elsewhere classified | 4 | 102 | 1,390 | 2,282 |
| Other chemical and allied industries | 7 | 113 | 320 | 1,014 |
| **Totals for Chemicals and Allied Products** | **11** | **215** | **1,711** | **3,296** |
| **Totals for All Industries** | **491** | **47,807** | **156,477** | **258,762** |

## 32 • SCRANTON-WILKES BARRE INDUSTRIAL AREA

Comprising Lackawanna and Luzerne Counties in Pennsylvania.

| Industry | No. of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Grease and tallow, not incl. lubr. greases | 4 | 25 | 67 | 130 |
| Insecticides and fungicides, and industrial and household chemical compounds n.e.c. | 3 | 18 | 56 | 126 |
| Other chemical and allied industries | 12 | 324 | 1,309 | 2,716 |
| **Totals for Chemicals and Allied Products** | **19** | **367** | **1,422** | **2,972** |
| **Totals for All Industries** | **606** | **24,982** | **52,627** | **111,857** |

## 33* • READING INDUSTRIAL AREA

Comprising Berks County, Pennsylvania only.

| Industry | No of estab. | [1]No. of workers | [2,3]Cost of materials | [3]Value of products |
|---|---|---|---|---|
| Soap | 3 | 9 | 54 | 88 |
| Other chemical and allied industries | 9 | (4) | (4) | (4) |
| **Totals for Chemicals and Allied Products** | **12** | **(4)** | **(4)** | **(4)** |
| **Totals for All Industries** | **471** | **42,338** | **56,067** | **124,949** |

## GRAND TOTALS FOR 33 INDUSTRIAL AREAS

| | | | | |
|---|---|---|---|---|
| **Chemicals and Allied Products** | **4,512** | **145,919** | **892,275** | **1,783,472** |
| **All Industries** | **92,293** | **4,091,192** | **15,296,062** | **27,619,879** |

### FOOTNOTES

* Rating estimated.

[1] Average number of wage earners for the year, not including salaried officers and employees. Part-time and full-time wage earners are given equal weight in calculating the average; therefore, the number reported exceeds the number of full-time employees necessary to perform the work done.

[2] Includes cost of materials, containers, fuel, and purchased electric energy.

[3] Values given in thousands of dollars. Profits and losses cannot be calculated from the Census figures because no data are collected for certain expense items, such as interest, rent, depreciation, taxes, insurance, and advertising. The aggregates for cost of materials and value of products include large amounts of duplication due to the use of products of some industries as materials by others. For the United States as a whole, this duplication amounts to about one-third the gross value of products.

[4] To avoid disclosing data for individual establishments, figures for "Other chemical and allied industries" in the Kansas City and Reading Industrial Areas have been lumped together. Therefore, in the 22 establishments in these areas thus classified in 1935, there were 1,268 wage earners, $13,045,000 for cost of materials, and $20,451,000 worth of products.

(*a*) and (*b*). To avoid disclosing data for individual establishments, figures for certain establishments outside the defined area have been included for these industries. (*a*) denotes one and (*b*) two external establishments.

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